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AUG 26 1929

Electrical World

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See Page 17

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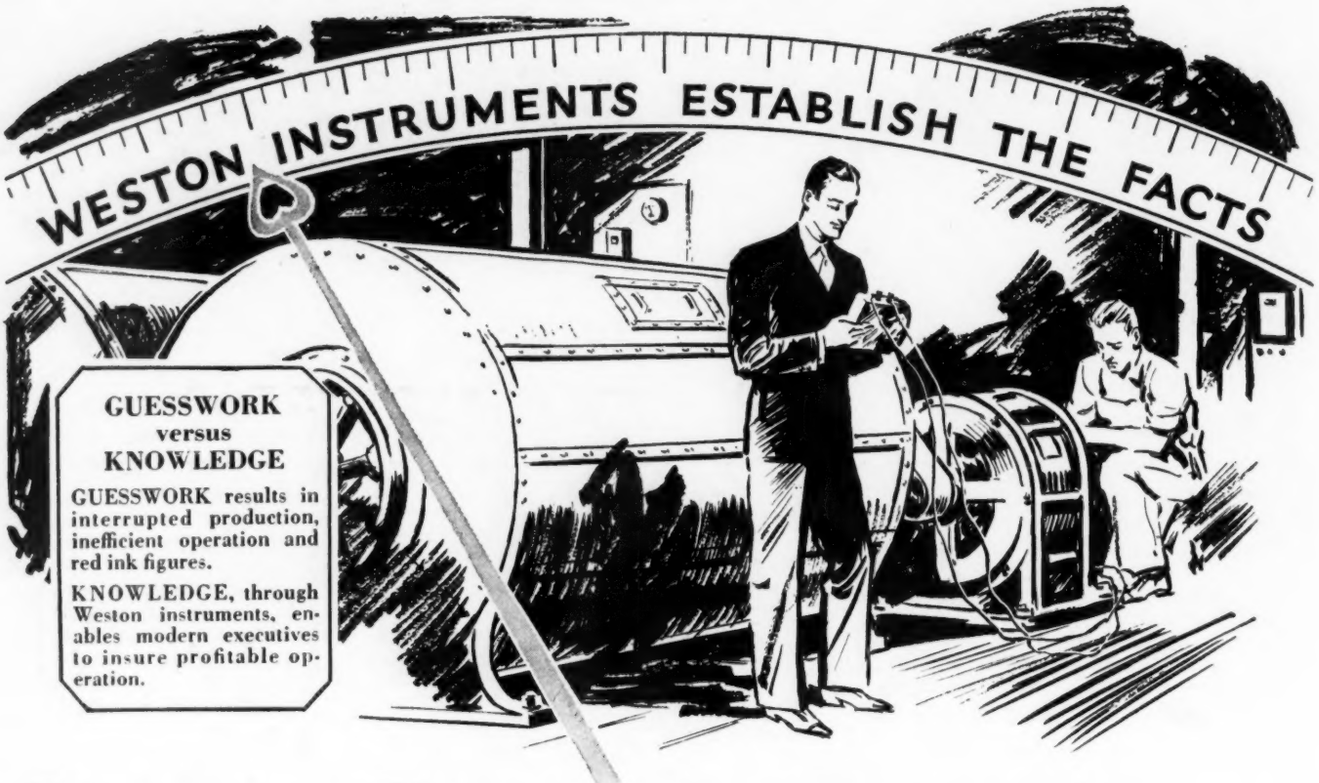
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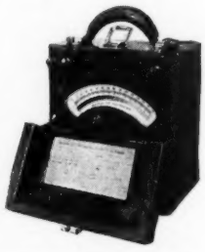

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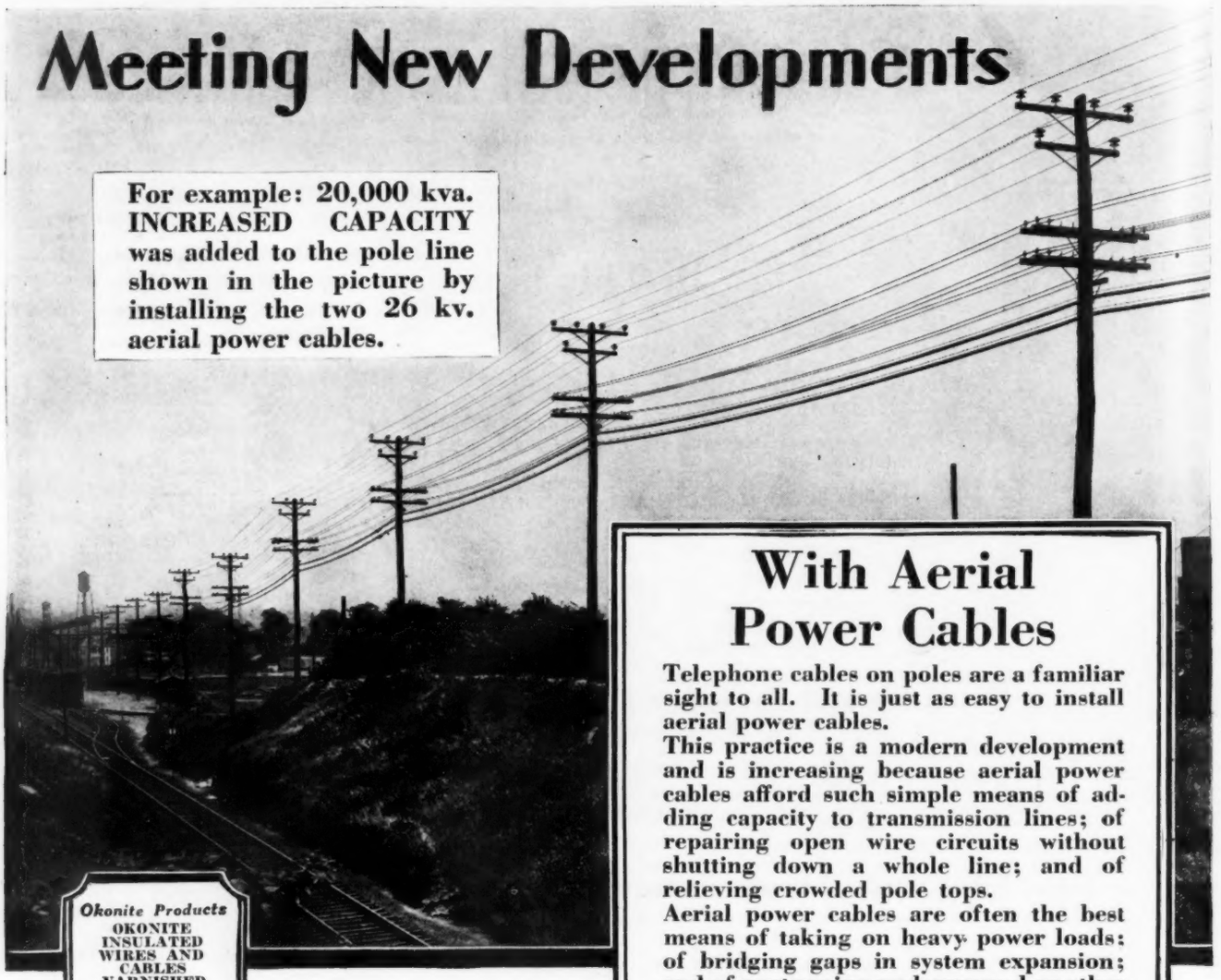
Meeting New Developments



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With Aerial Power Cables

Telephone cables on poles are a familiar sight to all. It is just as easy to install aerial power cables.

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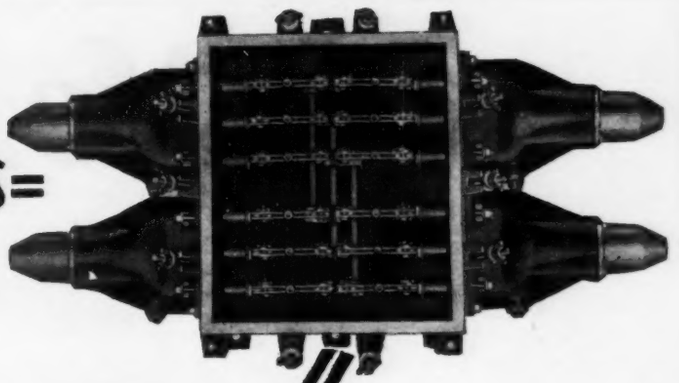


With disconnecting links for any size cable

Type HL boxes are built for one, two, three, and four conductors, for any number of cables, for any size of cable, for 600 volts. A successful type for interconnection between low tension feeders and for connecting mains to feeders. They have removable links with bolted contacts and are submersion-proof.

Box operation does not cease when a cable is damaged. The G & W unit plan of construction makes each cable a unit right up to the bus. The links are pulled. The cable head and cable are removed as a unit without disturbing the rest of the box. This is most valuable where service continuity is paramount. Additional cables can be added any time without disturbing rest of box.

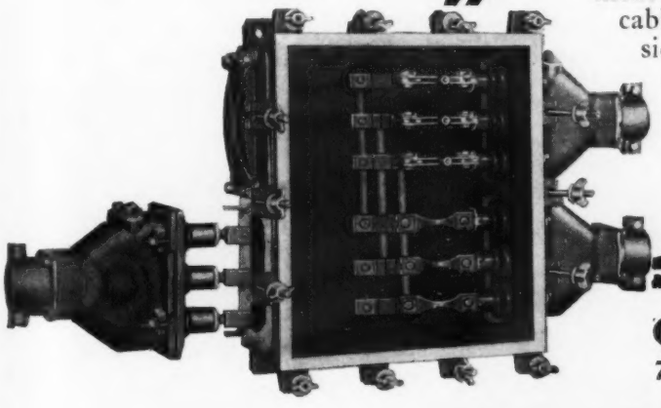
Type HL Boxes have many desirable features for "network" connections. Trouble isolation and cable sectionalization are easily effected at an economical cost. Use Type HL Boxes on your next underground layout.

TYPE HF BOXES

A fuse box for light or heavy currents

The G & W unit plan of construction in these 600 volts boxes, will appeal to the engineer who demands flexibility. Cable arrangements, link fuses, various ampere ratings, future additions, and finally, the actual operation of the box, are the flexibility features in the G & W design. Ease of installation and permanence are regular G & W characteristics.

The unit plan idea also makes the cable entrances interchangeable. Using single conductor or multiple conductor cables does not disturb the internal arrangement of the box. A 3-conductor cable head will fit the same side opening as three single conductor entrances. These boxes like the HL boxes are also used for "network" heavy cables. Furnished in all arrangements.



The HL and HF boxes are thoroughly immersion-proof. Between the lid and the box is a heavy rubber gasket. A 5-lb. air test at the factory guards against breathing through pores in the iron. Each box is furnished with a tire valve for testing in the field after box has been closed. The cable insulation terminates under compound in the cable head, preventing any moisture entrance.

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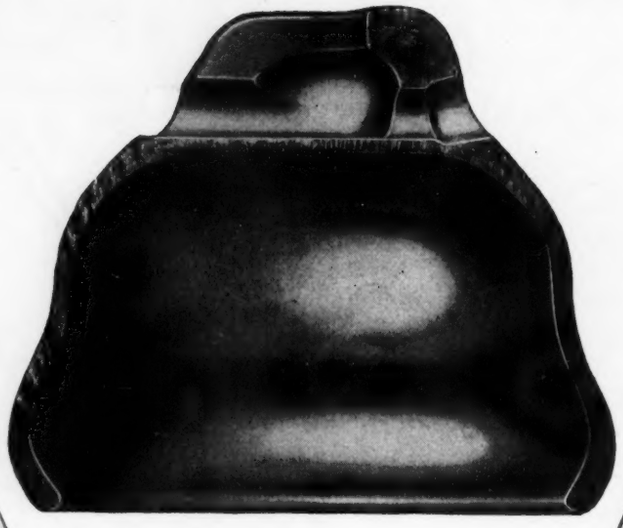
POTHEADS AND BOXES

Uniformity



THERE are two ways to obtain uniformity in the caps you use on your high tension suspension type lines. One -- to buy caps of questionable reliability and test each one, using only those which prove worthy. The other -- to buy caps of known uniformity -- a cap containing no hidden defects or concealed flaws.

A drop forged cap is solid grained, homogeneous and uniform in quality. There is no danger of hidden defects or concealed flaws. A BTC drop forged cap needs no testing after it leaves the factory - drop forged from Copper-Bearing steel to resist corrosion.

BTC

WHY a Drop Forged Cap?

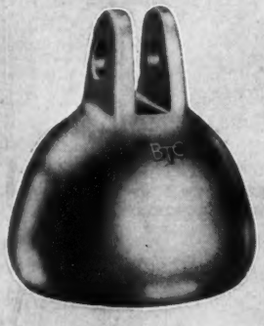
1 They are 100% uniform in quality.

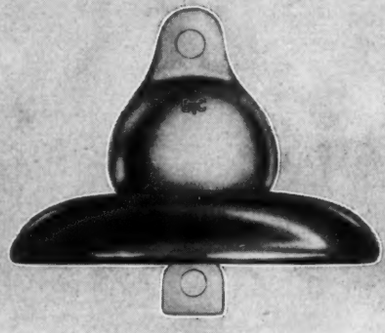
2 Copper-Bearing steel resists corrosion.

3 They are free from hidden defects or concealed flaws.

4 Their superior strength has been proven by many tests.

5 They can be heat-treated to a maximum strength with a minimum weight.





Specify BTC Drop Forged Caps

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The Brewer-Titchener Corporation

Cortland, New York

Electrical World

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L. W. W. MORROW, *Editor*

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Growing Over-All Load Factor a Sign of Health

ENORMOUS growth in generating capacity throughout the United States has been witnessed in the last few years, the increase, in accordance with latest statistics, having been from 17,960,000 kva. in 1922 to 31,300,000 kva. in 1928, or 74 per cent. Comments were made here and there by the ultra-conservatives about overconstruction of power houses, and even the most optimistic anticipated a temporary decrease in load factor during a period of adjustment when the new large units were being put in service with the smaller old units still operating.

It is more than encouraging, therefore, to find that the over-all load factor has been steadily increasing. Thus, in 1922, with a total of 43,560,000,000 kw.-hr. generated, the load factor for the whole country was 27.7 per cent. In 1926, with a generating capacity of 26,813,000 kva., producing 69,158,000,000 kw.-hr., the load factor was 29.4 per cent. For 1927 it is reported that 28,970,000 kva. in generating capacity produced a total of 75,116,000,000 kw.-hr., the load factor being 29.6 per cent, and in 1928 the total production was 87,849,000,000 kw.-hr. at a load factor of 32 per cent. The great period of construction from 1922 to 1925 shows an increase in load factor from 27.7 per cent only to 28.7 per cent, due evidently to adjustment. But 1926 begins to show the results of the new power houses with an increase in load factor in one year from 28.7 per cent to 29.4 per cent, and 1928 shows a remarkable increase from 29.4 per cent to 32 per cent. Stated in another way, from 1922 to 1928 the installed capacity increased 74 per cent but the generated energy increased 101 per cent.

These data afford definite proof that power-house extensions and new construction have been undertaken on a very conservative basis. They offer further proof of the benefit of interconnection. It may be safely predicted that the load factor will continue to increase as larger and larger power houses are built and smaller ones abandoned.

* * * *

Investment Trusts and Utility Securities

ONE can scarcely pick up a daily paper at present without being informed that a new investment trust has been born into the financial family, and the total number of these pools now in business is sufficient to exercise a considerable influence upon the market for utility securities. The competition of these assemblies of holdings to add desirable equities to their portfolios is undoubtedly a factor in current price levels, since purchases need to be made at as low figures as may be in order to obtain the full benefits of appreciation, if such there be, and also to minimize the effects of subsequent recessions in the ebb and flow of world markets for high-grade holdings. It is readily apparent that active bidding for securities tends to stabilize prices with respect to downward movements if not in upward.

The multiplication of investment trusts has a tendency, for the time being at least, to prolong the process of centralization of control which is the outstanding development of the utility industry as these lines are written. As the distribution of minority interests in local, regional and grouped properties increases it becomes more and more difficult to establish a nation-wide monopoly of financial control in the light, power and communication fields. Hence the contentions of some people that the country is fast approaching the point when it will be in the grip of an octopus known as the "power trust" may easily be resolved into phantoms. It is true that a comparatively small number of major groups now exert a powerful influence upon the development and operations of the industry, but the total capital investment in utilities in North America is such a colossal sum and so widely distributed that the assumption of an early achievement of a monopoly of continental scope betrays a highly distorted perspective. Controls may be consolidated and pyramided in time to heights still far out of reach and a national system may result, but in any such process the investment trust will have to be reckoned with on terms that will demand business ability and foresight of the first magnitude. Thus the investment trust may be classed as a balance wheel of great importance in the progress of the utility industry and its multiplication characterized as a stabilizing factor in the economic history of the country.

* * * *

The Couzens Bill and the State Commissioners

CONGRESS when it meets in regular session next December will undoubtedly have before it some measure seeking to regulate the interstate business of electric power companies. Senator Couzens of Michigan has already introduced a bill to create a commission for the regulation of "transmission of intelligence by wire and wireless" which has been amended to give the commission regulatory authority over power transmission also. Exactly what shape that measure will finally take, it would be vain to guess; but as it is, it has already stirred the commissions of the several states to demand some action at the convention of their association next week. Naturally, after their experience with the transportation act of 1920, the state commissions are apprehensive that the enactment of the Couzens bill will seriously curtail the measure of control over public utilities which state authorities are now exercising.

But what of the public utilities? Are they to have another commission foisted on them from Washington to crush out all ambition and initiative and convert a progressive, enthusiastic and fast-growing industry into a drab, flat, dull, do-nothing, bureau-ridden affair, satisfying neither the producer nor the user of electrical energy? The electric public utilities are now regulated by state commissions. In addition, some are under the jurisdiction of the Federal Power Commission, and now Senator Couzens hopes to pile a "Communications Commission" on top of that. There may be strength in a multitude of counselors, but anything but strength in a multitude of commissions.

The public utilities of the country accept public regulation in return for monopoly of supply. In the interest of effectual public control they have a right to object to too many commissions, for no man can serve many masters. The utilities recognize that, however far-flung their systems may become, the business of supplying electric service is essentially local as opposed to national in character. For the national government, therefore, to undermine state utilities commissions and state responsibilities by further encroachments in the field of regulation is nothing short of vicious centralization, which every commission, every city and every state should oppose most vigorously. The utilities themselves have little choice in the matter. Generally speaking, they prefer one virile regulatory body with ample powers. State regulation has thus far proved itself fully adequate to control the situation, and if democracy is to retain mastership in its own house, state regulation must still prevail. We trust the commissioners' association will take a very firm and determined stand on this matter.

* * * *

Is Being Different Worth the Cost?

THERE is no one who should appreciate more clearly than the engineer of an operating organization just what performance and design are required of the equipment with which energy must be generated, transmitted and distributed and with which high-grade service must be maintained. His should be the voice which calls for certain performance characteristics. His should be the decision in regard to the equipment with which he must work. But he may well be relieved of a variety of detailed design problems involved in mechanical and structural layouts and in other repetitive essentials.

There are an inconceivable number of substations of temperamentally variant types to be found. Yet there are an amazing similarity and identity in the service requirements and available sites, areas and ground conditions involved. The many variations yield no incomparably better performances, and it would be well to accept more widely the standard layouts and block designs such as have been developed by a number of organizations for the simplification of construction work.

Standardization in the utility field has scarcely begun, and it is here that further accomplishments in some of the eagerly sought economies which have become so highly prized may be anticipated. The cost of "being different" is seldom low, whether for organizations or individuals. It is often the most worthy luxury imaginable—to some individuals it is as essential as are the bare necessities of life—but when it can show no outstanding benefits, no major savings, no greatly improved appearance, then standardization may well be invited and welcomed. There is no need to start afresh and design a whole structure when a new station is needed. A standardization program by the general office staff, leading possibly to co-operative reccommendation studies by the N.E.L.A., should aid in relieving operating organizations of much design work. It costs too much to be different.

* * * *

Keeping Design Diaries

CARTE-BLANCHE permission to examine the engineering files of an electrical designing organization is a privilege rarely granted to outsiders, but on such occasions what would one not give to come across some form of diary which "hits the high spots" involved in making decisions for and against various aggregations of equipment and diverse arrangements thereof? It is needless to reiterate the importance of reducing clerical burdens to the minimum in connection with the adoption of engineering schemes, and yet there is little doubt that the fruits of much costly thinking are in part lost in many a designing office because of the high mortality permitted in connection with discarded studies.

Under present conditions it is necessary to depend upon the memories of designing engineers as to the alternatives considered in many undertakings, usually many months after the field work has been completed. Unless the project is large enough to command a comprehensive report comparing schemes and methods, many ideas of value tend to get "lost in the shuffle," and the result is that ground once covered has to be gone over repeatedly in much future work.

Engineering progress is too rapid to justify overloading the memory in such matters, and some form of job diary containing at least skeletonized summaries of reasons for schemes rejected and adopted deserves wider consideration.

* * * *

"Circuit Breakers Without Oil"

THE oil circuit breaker is now a reliable piece of equipment and can be depended upon to break the short circuit for which it is specified. Its performance is based on the assumption that mechanism and contacts do not fail to function exactly as the designer intended them to function. Should they fail to function, should the breaker not open completely or not open fast enough, the accumulation of gases might become greater than the usual vents can handle and an oil fire would result —one of the greatest of all hazards in a power house or a substation. In very recent years, therefore, attempts have been made to develop heavy-duty breakers which require no oil. The first attempt was the vacuum breaker, which has been initiated in this country and has worked satisfactorily in some tests, but about which most manufacturers and operators seem to be skeptical. Then came the ingenious Deïon breaker, also an American development, the result of a thorough scientific study of the arc.

Now it is reported from Germany that a new oilless circuit breaker has repeatedly broken 500,000 kva. This new breaker is based on a principle diametrically opposite to that of the vacuum breaker. It forces compressed air into the arc and blows it out. It is indeed encouraging to find that, after many years in the circuit-breaker field barren of new ideas, three promising methods of switching have been brought out in such a short time. It is

astonishing at first thought to find that all these ideas were brought out, not by practical traditional switch designers, but by scientists. Thus is given another proof of what pure scientists can do, once they obtain the opportunity and the means to study a problem. Even though not all of the new types of breakers are as yet commercial articles, additional studies of the problem by the same and other scientists will no doubt sooner or later bring forth practical commercial switches which will break a circuit without the oil hazard and at least provide a workable associate of the well-proved oil breaker.

* * * *

Reliability of Service Can Be Too Costly

THE American public has been educated to look upon electrical energy supply in two strangely conflicting ways. One is that it is a commodity skillfully metered and accurately invoiced in unit measures; the other is that it is a service with considerable emphasis upon the continuity and reliability.

The first notion creates somewhat of a sales resistance to the program of more kilowatt-hours per customer and the second notion constitutes a real stumbling block to the distribution and transmission engineers in cutting investment costs per kilovolt-ampere and per customer.

Efforts to assure continuity of service may be overdone. For example, a district manager in his zeal for rendering service recently sent out his line gang at midnight to replace a transformer that had been burned out by lightning earlier in the evening. Artificial light was no substitute for daylight and one of the gang lost his life in the difficult task. Considering the hazard of working among live wires after dark, and particularly the lateness of the hour, would it have been unreasonable in this case to delay service restoration until daylight arrived?

No doubt, also, many companies would find on reviewing their construction practices that they are going to high unit expense to attain the last degree of reliable service.

Isn't it possible that there is a tendency to overemphasize continuity of service and carry it to the point where the cost outweighs the benefit to the public?

* * * *

Supply the Incentive to Sell

MUNICIPAL lighting plants in many localities are today confronted by serious economic handicaps. An enormous proportion of the electrical energy produced and marketed by central stations is now privately generated and distributed under state regulation. Few municipal plants compare in size with those of the power companies, and interconnection has made almost no headway among the scattered plants run by public authority which still dot the map in isolated spots in various localities of the United States. It looks as though the economies of mass production, bulk transmission and well-planned distribution were fast becoming irresistible, since these in the long run cannot help making for better service and lower prices under management governed by the policy of doing the best possible job for the communities concerned.

These economic handicaps, however, are not always sufficiently compelling to bring about a decision in favor of private ownership when the time is ripe to sell the municipal plant. It is distinctly "up to" the power companies to supply a real sales incentive in making purchase offers and to emphasize the advantages of the new arrangement in terms which the humblest intelligent citizen can comprehend. Specific offers in money for a municipal plant should be discussed when possible in connection with proposed improvements which will thus be facilitated in the city or town, and the effect of such a sale upon the taxation situation may well be stressed from every feasible angle.

There is nothing out of place in putting such offers before the people on the basis of a fair trade. If the service is to be improved and if rates are to be more favorable in connection with a larger use of electricity in the community under the new régime, this is certain to be emphasized; but in many cases this is not the whole story. It is natural and proper for each party to the negotiations to seek to realize the most favorable terms possible, but unless every advantage of the transaction is made clear to the public in the shape of an incentive to sell, negotiations may be delayed or even fall by the wayside at times in the development of a regional power situation which may never again be duplicated.

* * * *

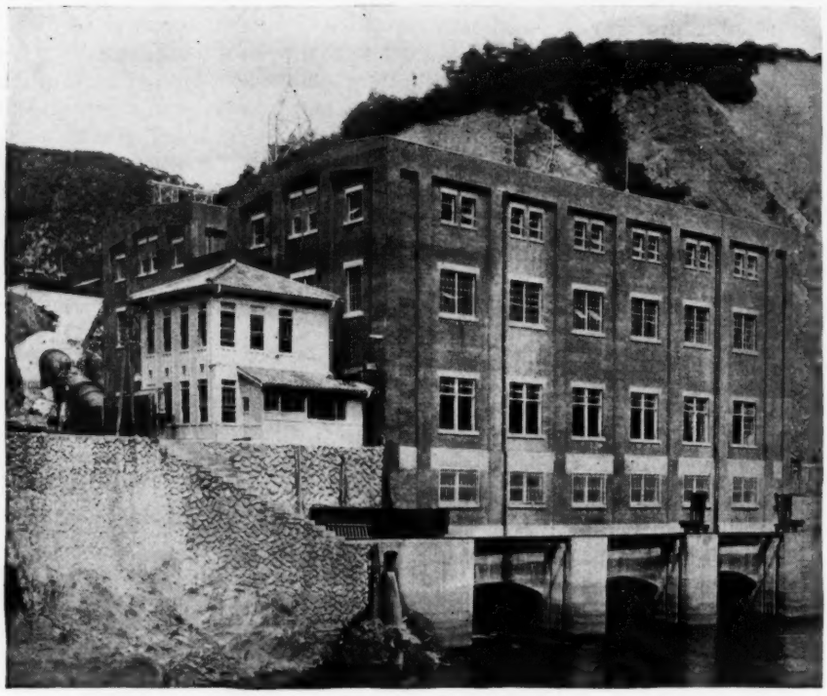
Lightning Not the Only Threat to Transmission

ON A SERVICE basis good transmission practice gives fifteen to twenty interruptions per year per one hundred miles of 100-kv. line according to a survey made by the Great Lakes Engineering Section of the N.E.L.A. From seven to ten of these interruptions were attributed to lightning, and for two successive years lines without ground wires suffered almost twice as many lightning interruptions as did those provided with ground wires. These data undoubtedly show the ability of ground wires to reduce lightning troubles. But lightning troubles are less than 50 per cent of the service interruptions, and there is a big opportunity for improvement in performance by eliminating chances for mechanical failures, improving relay operation, providing for better switching and insuring proper clearances to ground and between phases. These things can be done to the advantage of the service.

The superior efficacy of the double-circuit line as compared with the single-circuit line is shown by the data in that only 15 per cent of the troubles caused a simultaneous trip-out of both circuits. It is also interesting to note that only about 6 per cent of lightning flashovers resulted in burnt-down lines and that data on porcelain injured from arcs or punctures were very meager.

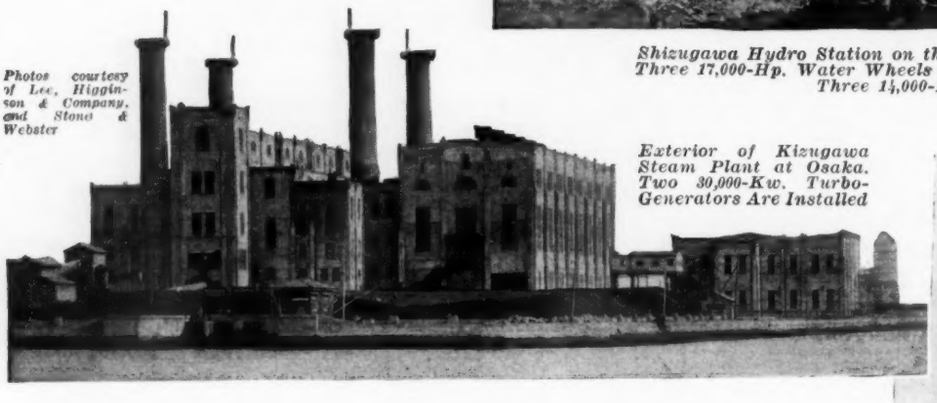
Continuous, uninterruptible transmission service is still in the future. The engineers of the industry will not stop developments so long as lines cannot be counted upon for less than an average of twenty interruptions per hundred miles per year. And improvement in service performance need not wait for an intimate knowledge of lightning. It can be had by a thorough study of the insulation and mechanical features of a line, by installing the right kind of protective equipment in a correct manner at proper locations, and by devising an operating method that takes full advantage of all possibilities. There is no reason to doubt the economic feasibility of holding interruptions down to the order of ten instead of twenty interruptions per year per hundred miles of line. Experience data are available, and capable engineers can apply them to get this result.

Interconnected System Serves Important Areas in Japan

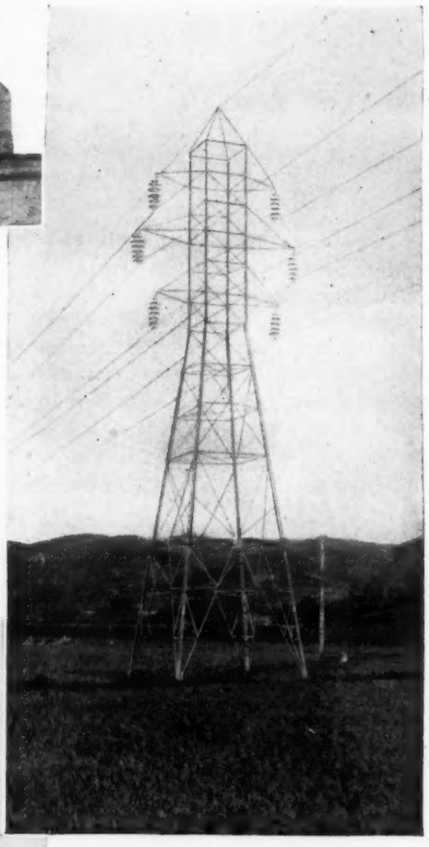


Shizugawa Hydro Station on the Ujigawa River. This Plant Has Three 17,000-Hp. Water Wheels Operating Under 150-Ft. Head and Three 14,000-Kva. Generators

Photos courtesy of Lee, Higginson & Company, and Stone & Webster

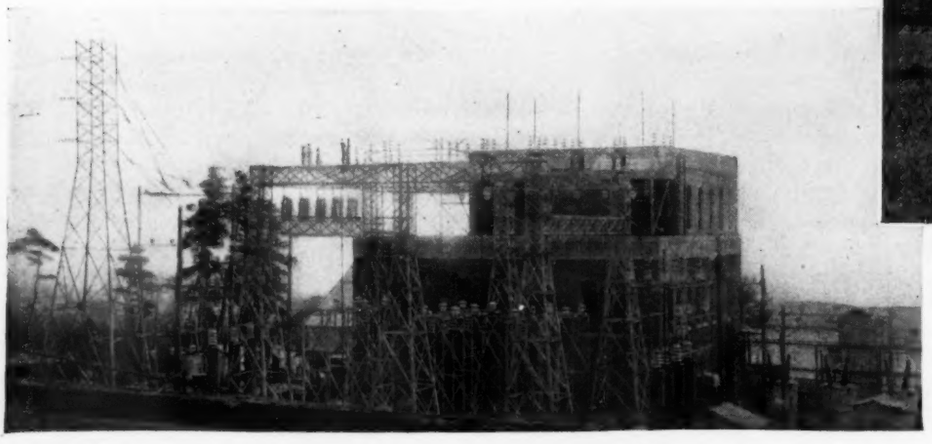


Exterior of Kizugawa Steam Plant at Osaka. Two 30,000-Kw. Turbo-Generators Are Installed



Tamate Transmission Line

TWENTY generating stations of 188,670 kw. capacity have been welded by interconnecting transmission lines into a comprehensive power system serving the Osaka-Nagoya region of Japan by the Ujigawa Electric Power Company, Ltd. Sixty substations and sixteen switching stations have been completed, and the company's lines reach 260 municipalities. Nineteen hundred square miles are served by about 525 miles of transmission line routes. The total steam plant capacity is 100,000 kw., hydro plants 88,670 kw. and 13,507 kw. in water-power installation under construction. The system is a 60-cycle installation and the maximum transmission voltage is 77 kv. Power is also purchased from other companies.



Kobe Outdoor Sub and Switching Station

Wasting Power Worth Millions

An Interview with

WALTER S. WYMAN
President Central Maine Power Company and New England Public Service Company

ON SEPTEMBER 9 next the citizens of Maine are to vote upon the Smith-Carleton power exportation bill, which passed the last Legislature by an overwhelming majority and which provides adequate machinery under commission regulation for the disposal outside the state of power now going to waste. The recent decision of the Public Service Commission of New Hampshire authorizing the exportation of power in large blocks from Fifteen-Mile Falls on the upper Connecticut River into Massachusetts brings into sharp contrast the situation in Maine and was followed by an inquiry by an editor of the ELECTRICAL WORLD of W. S. Wyman, president of the Central Maine Power Company, as to the prospects of securing a referendum vote in the fall in favor of the regulated exportation of surplus hydro-electric energy from the Pine Tree State and the bearing such action would have upon the power situation in Maine.

Walter S. Wyman

"This is the most important matter which will come before the people at the fall referendum," said Mr. Wyman. "For twenty years we have had the Fernald law forbidding water-power exportation. This law did little harm during the first ten years because the electrical industry was not developed to a point where it was possible to export electricity on any substantial scale, and the total amount going to waste was small enough to be greatly reduced by the interconnection of different local plants. This interconnection has been accomplished, so that now nearly all the large producers of power in the state are able to interchange energy.

LOW PRICES DEMAND LARGE PLANTS

"During the past ten years, however, it has become increasingly important that the electric power stations which are built to supply the demands in Maine be as large as possible in order to secure low-priced electricity. This means that during the first two or three years plants are used a great deal of power goes to waste in them, power which the Maine market cannot absorb and which can only be absorbed by some system that ordinarily operates on steam and can shut down that steam and buy cheap water-generated energy for the time being.

"An example of this is our Gulf Island plant. During the first year this plant was in operation, which happened to be a year of unusually good rainfall, about 125,000,000 kw.-hr. went to waste over the company's dams. That amount has gradually diminished as the company's load has been built up, and probably if no hydro-electric plants were added would entirely disappear by 1932. This, in turn, would mean that a large amount of power would have to be made by steam in dry times.

"We are now building another power station nearly three times as large as Gulf Island at Bingham on the Kennebec River, and unless some almost miraculous market offers itself for this power within the state there will be a surplus of from 150,000,000 to 200,000,000 or perhaps even 250,000,000 kw.-hr. on our system during the first twelve months that this Bingham plant is in operation. The total amount of energy which will go to waste in the ten-year period on the Central Maine Power Company's system alone makes an astonishingly large figure. During the ten years from 1925 to 1935 it might be more than 1,000,000,000 kw.-hr.

WASTING POWER WORTH MILLIONS

"What can be obtained from this waste power if it were exported no one is in a position to say. The price per kilowatt-hour which would be paid for it would depend wholly on the time of day, the number of days in the year and the number of years that it is available to power users.

"It has been repeatedly stated that I have said this power would be sold for 5 mills per kilowatt-hour. There is no foundation for this statement. It would be sold at such a price as could be had for it. It might be more, or less, but sold at any conceivable price, the total return in dollars and cents would be large. If the price were as low as 2 mills a kilowatt-hour it would bring $2,000,000; if sold at 5 mills a kilowatt-hour it would bring $5,000,000, and if sold at 1 cent per kilowatt-hour it would bring $10,000,000.

"The opponents of export have objected repeatedly and strenuously that if this power were once exported the state would lose all control over it. This we do not believe, as Maine is the only state in which export of power is prohibited, and yet the other states seem to have as good control over their power companies as Maine has.

"One peculiarly striking thing is that the states which are exporting the most power are the ones that appear to be most prosperous. They are the ones which are allowing their resources to be developed and used and not keeping them idle.

"However, to meet this objection, the Smith-Carleton

bill was devised. It was written by Edward F. Merrill of Skowkegan with the advice and counsel of Harry Verrill of Portland, William B. Skelton of Lewiston and Leonard Pierce of Portland. These men were instructed to write a law which would protect the State of Maine in every possible way and give it the fullest control over its export business, and they all feel that they have done this.

Close Regulation Provided

"When the Smith-Carleton bill becomes a law the export of power can only be carried on by corporations formed under it for that purpose. These corporations cannot develop any power of their own and no power company in the state can sell power to the export companies without getting a license from the Public Utilities Commission of Maine. In order to get that license the power company must enter into a contract with the state by which it binds itself to conform to all the conditions laid down by the Utilities Commission and by the law. A public utility company selling power under this law for export must expend an amount equal to one-half of the income which it receives from this source on lines for rural electrification up to a maximum of $250,000 a year for ten years. In addition to this the state collects a tax from the 'export companies' of 4 per cent on all the revenue they receive.

"The passage of this law means more to Maine in a business way than any other law which has been before the people for a long time. The freedom to export power which would otherwise go to waste would mean much more rapid development of our water powers. It will mean the receipt of large sums of money every year by the state in taxation. It will mean the possibility of securing large users of power to locate their plants in Maine, and if the waste power can be sold it will mean a more rapid reduction in rates for electricity in Maine.

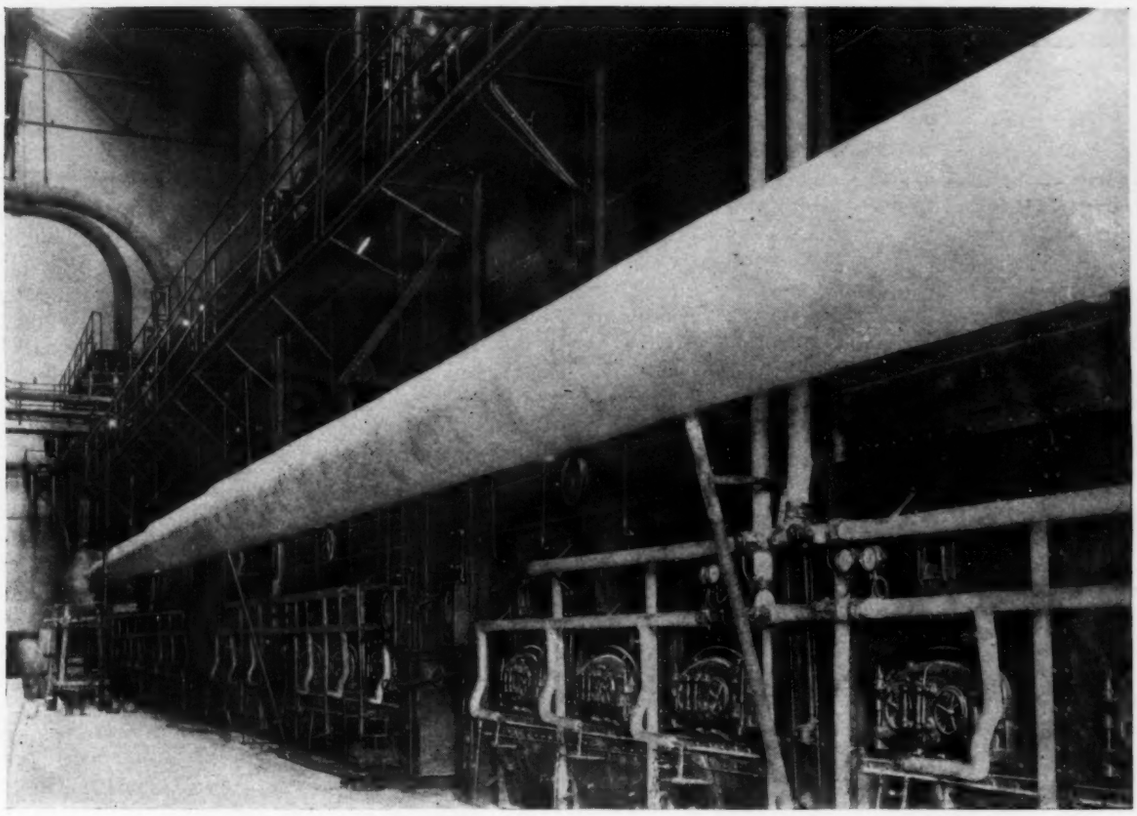
"It does not seem to me that there is the remotest possibility of any light and power company doing business in this state seeking to sell power for export in preference to selling it here. This company, for example, has about $40,000,000 invested in property located in Maine, a large part of which can be used only for supplying electricity to the people of this state. The only way we can prosper is by having more and more people live here to use those facilities, and the only way we can make lower rates to our customers is by making the fullest possible use of every bit of property which we own."

Intensities Recommended for General Commercial Illumination

(Franklin Specification, Society for Electrical Development)

	Foot-Candles Recomd.	Foot-Candles Req. Min.
Armories		
Drill sheds	10	6
Exhibition halls	12	8
Art Galleries		
General	5	3
*On paintings (local)	25–100	10
Auditoriums	5	3
Automobile Show Rooms	15	10
Bank		
Lobby	10	6
Cages and offices	15	10
Barber Shop	15	10
Baseball—Indoor Game	15	10
Basketball	15	10
Bowling		
On alley, runway and seats	8	5
*On pins (local)	25	15
Billiards		
General	6	4
On table (local)	25	15
Cars		
Baggage, day coach, dining, Pullman	8	5
Mail—		
Bag racks	12	8
Letter cases	15	10
Storage	6	4
Street railway and subway	10	6
Churches		
*Auditorium	3	2
Sunday school room	8	5
*Pulpit or rostrum	12	8
*Art glass windows (local)	25–50	15
Club Rooms		
Lounge	5	3
Reading room	12	8
Court Rooms	10	6
Dance Halls	6	4
Dental Offices		
Waiting room	6	4
Operating office	12	8
*Dental chair (local)	50	25
Depot—Waiting Room	8	5
Drafting Room	25	15
Elevators		
Freight and passenger	6	4
Fire Engine House		
When alarm is turned in	8	5
At other times	3	2
Gymnasiums		
Main exercising floor	12	8
Swimming pool	8	5
Shower rooms	6	4
Locker rooms	6	4
Fencing, boxing, wrestling	12	8
Halls, Passageways in Interiors	3	2
Handball	25	15
Hospitals		
Lobby and reception room	6	4
Corridors	3	2
Wards (with local illumination)	5	3
Private rooms	8	5
Night illumination	0.2	0.1
*Operating table (local)	100–200	75
*Operating room	15	10
Laboratories	15	10
Hotels		
Lobby	8	5
Dining room	6	4
Kitchen	10	6
Bedrooms	8	5
Corridors	3	2
Writing room	12	8
Library		
Reading rooms	12	8
*Stack room	6	4
Lodge Rooms	6	4
Lunch Room	12	8
Market	12	8
Moving Picture Theater		
During intermission	5	3
During pictures	..	0.1
Museum		
General	8	5
*Special exhibits (local)	25–100	10
Office Buildings		
Private and general offices—		
Close work	15	10
No close work	10	8
File room	6	4
Vault	6	4
Reception room	6	4
Post Office		
Lobby	10	6
Sorting, mailing, etc.	15	10
Storage	10	6
Private and general offices	15	10
File room and vault	6	4
Corridors and stairways	3	2
Railway		
Depot—waiting room	8	5
Ticket offices	12	8
Rest room, smoking room	8	5
Baggage checking office	12	8
Storage	6	4
Concourse	6	4
Train platform	4	2
Restaurants	8	5
Racquets	25	15
Schools		
Auditorium	8	5
Class rooms, library and office	12	8
Corridors and stairways	5	3
Drawing	25	15
Laboratories	12	8
Manual training	12	8
Sewing rooms	25	15
Study rooms—		
Desks and blackboards	12	8
Skating Rink (Indoor)	8	5
Squash	25	15
Stores—Department and Large Specialty		
Main floors	15	10
Other floors	12	8
Basement store	15	10
Stores—Medium Size		
Art	12	8
Automobile supply	12	8
Bake shop	12	8
Book	12	8
China	12	8
Cigar	15	10
Clothing	15	10
Confectionery	12	8
Dairy products	12	8
Decorator	12	8
Drug	15	10
Dry goods	15	10
Electrical supply	15	10
Florist	12	8
Furrier	15	10
Furniture	15	10
Grocery	12	8
Haberdashery	15	10
Hardware	12	8
Hat	15	10
Jewelry	15	10
Leather, handbags and trunks	12	8
Meat	12	8
Millinery	15	10
Music	12	8
Notions	12	8
Piano	12	8
Shoe	15	10
Sporting goods	12	8
Tailor	15	10
Tobacco	15	10
Variety store	15	10
Telephone Exchanges		
Operating rooms	8	5
Terminal rooms	12	8
Cable vaults	6	4
Tennis (Indoor)	25–50	15
Theaters		
Auditorium	3	2
Foyer	8	5
Lobby	12	8
Toilet and Washrooms	6	4

*In interiors marked with asterisk (*) other factors, such as the direction of light, its color quality or the type of the fixture, are of unusual importance and require special study.



Main Gas Duct for Delivering Bled Flue Gas to Standby Boilers

Flue Gases Heat Standby Boilers

One boiler under fire keeps five standby boilers hot by use of flue gas header. Three barrels of oil per day per boiler saved

By V. F. Estcourt
Efficiency Engineer Station A,
Pacific Gas & Electric Company, San Francisco, Calif.

ON THE system of the Pacific Gas & Electric Company several steam plants are operated in parallel with a number of hydro-electric stations. The usual practice is to operate the steam plants either wholly or partially standing by to protect the incoming hydro-electric load, so that in case of any interruption the steam plants can immediately pick up the load dropped by the hydro-electric system. This requires a number of boilers to be kept up to steam line pressure and ready to generate steam as soon as the fires are lighted. The usual method of keeping these standby boilers hot is to fire them up at stated intervals of time; that is to say, the boilers are fired until brought up to line pressure and the fires then extinguished, but at the end of three or four hours boiler pressure has dropped off about 15 or 20 lb. and it is then necessary to fire them up again in the same manner.

Recently the Pacific Gas & Electric Company installed at its station A, in San Francisco, an entirely different system of keeping boilers hot and at a considerable saving in fuel. Flue gases are bled from a boiler in regular operation and discharged by means of a fan through a heavily insulated duct leading to the furnaces of the boilers to be kept hot. This duct is installed along the fronts of the boilers above the oil burners, as shown by the accompanying illustration. Connection to each boiler is made through the front wall as shown by the diagram. This method has been applied to six oil-fired class M-30 Stirling boilers, each having 8,226 sq.ft. of heating surface and operating at a steam pressure of 200-lb. gage. One of these boilers, at which the fan is installed, is operated continuously and the other five boilers are kept hot for standby service by the gases bled from this boiler. The fan is operated by a 7½-hp. variable-speed motor and the speed is controlled so as to maintain zero pressure in the furnaces of the standby boilers. This prevents any infiltration of cold air through the boiler setting.

Quick Response

If the standby boilers are required to meet a sudden increase in load it is necessary only to open the fan motor switch and close the fan discharge damper. This can be done in a few seconds and the boilers are then ready for firing. The individual regulating dampers at the boiler inlets should also be closed, but this may be done later as soon as time permits. If the boilers are operated at heavy loads for any length of time it is also desirable to open the ventilating damper at the end of the gas duct, as indicated in the diagram, in order to permit a very small quantity of air to be drawn as leakage past the closed regulating dampers at the boiler inlets. This will keep the boiler inlets cool without any perceptible increase in excess air in the furnace. If any increase in excess air is noticeable it can be offset by adjusting the main bolier dampers. With boilers equipped with front-shot type of oil burner these precautions for keeping the gas inlets cool might not be

necessary, but the boilers to which the installation has been applied are equipped with back-shot burners and the flame "shoots" almost directly at the flue gas inlets.

Savings Are Large

Tests have shown that the amount of fuel oil required to keep boilers of this size hot by the old method of firing them up every three or four hours averages approximately three barrels per day for each boiler. With the new method, if the gases are taken from the breeching of the supply boiler, the standby boilers are kept hot entirely by waste gases, so that the whole quantity of three barrels per day for each boiler is saved. In the present installation, however, the fan suction was connected at the bottom of the second pass (see diagram) to insure obtaining gas at a high enough temperature to keep the standby boilers hot, but it has since been found that the installation will operate satisfactorily if the gases are taken from the breeching.

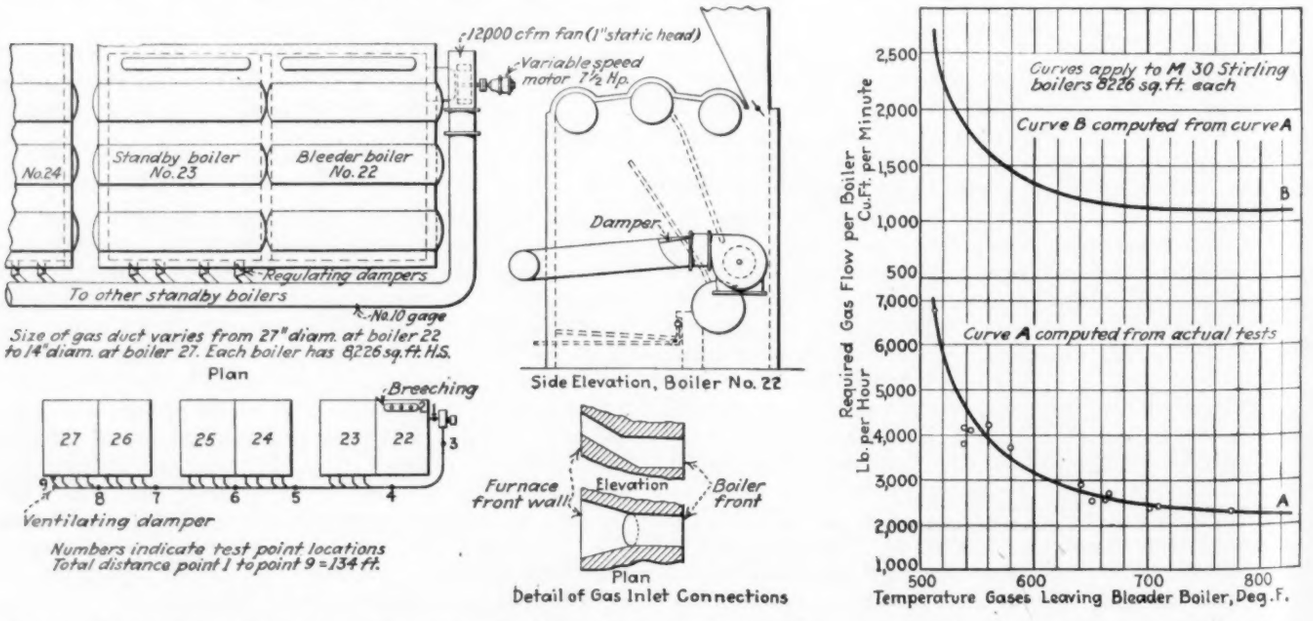
With the fan suction located at the bottom of the second pass there is some heat remaining in the gases that would be absorbed in the supply boiler if it were operated without bleeding. In order to determine the net saving in this case the amount of heat in the gases removed that could normally have been utilized must be computed in terms of equivalent barrels of fuel oil and subtracted from the amount of oil required to keep the boilers hot by the old method. In this particular installation the amount of useful heat bled from the supply boiler has been found to be equivalent to 0.6 bbl. of fuel oil per day for each of the boilers kept hot. The net saving is therefore 3.0 — 0.6 or 2.4 bbl. per day for each standby boiler. For the present installation on five standby boilers this amounts to from three to four thousand dollars per year, the exact amount depending upon the load conditions; that is, upon how much standby service is required. Thus the first year of operation more than pays for the entire cost of installation.

Certain other benefits are derived. For example, the system provides better standby service. Under the old method of firing up boilers periodically, the boiler pressure will drop 15 or 20 lb. below line pressure during the intervals between firing up, but with the new system the full boiler pressure is maintained at all times. The standby boilers are therefore always ready to go on the line immediately fires are lighted under them. Also, the continuous flow of hot gases into the furnace practically eliminates the detrimental effects on furnace brickwork due to the sudden large temperature changes caused by the frequent lighting and extinguishing of fires neecssary when using the old method.

It can be seen that the hotter the flue gas supplied to the standby boilers the less will be the gas required. The accompanying curves were plotted from actual test data and show the relation between temperature and the rate of gas flow to each standby boiler required to maintain full boiler pressure. The curves are based on gas temperatures at the fan suction; the average temperature drop between this point and the five standby boilers varies approximately from 15 deg. F. with high gas flow rates and low temperatures to 50 deg. F. with very low rates of flow and high temperatures. It should also be noted that for gas temperatures below about 540 deg. F. a small decrease in temperature will necessitate a very large increase in the amount of gas supplied. The system is thus somewhat unstable below this temperature and it is therefore advisable to operate the supply boiler at a sufficiently high rating to give a gas temperature above 540 deg. F. at the bleed point.

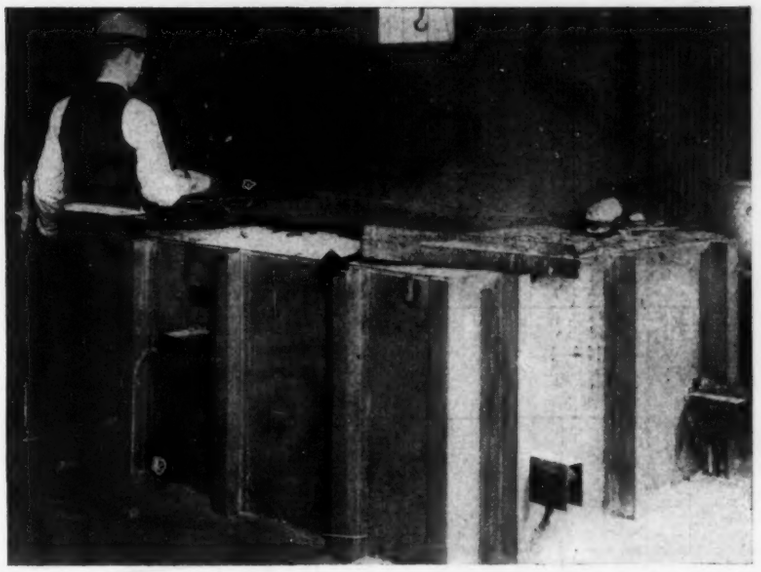
Only a limited amount of performance data has been given here, because any contemplated installation would have to be worked out as an individual problem, there being a number of variable factors involved. The temperature-flow relationship given by the accompanying curves should, however, provide a fairly reliable basis for estimating the requirements to meet a given set of conditions.

It is conceivable that the system could be employed to advantage not only in standby plants but also to meet certain peak-load conditions where it is necessary to put additional boilers on the line at certain times of the day. The cost of bringing these peak load boilers up to line pressure could thus be eliminated.



Arrangement for Keeping Standby Boilers Hot by Flue Gases and Relation Between Temperature and Rate of Flow of Gas Required to Keep Standby Boilers Up to 195-Lb. Pressure

Electric Galvanizing Tank Cuts Cost One-Half



Production Rate of 1,600 Lb. per Hour Is Attained with Electric Galvanizing Tank at Large Saving Over Gas

DEFINITE economies over gas fuel amounting to more than 13 cents per pound of material galvanized have been found in tests on a new electrically heated galvanizing tank at the Alhambra shops of the Southern California Edison Company. The tank is 3 ft. x 5 ft. x 3 ft. inside measurement and is equipped with 70 kw. in three-phase, 220-volt General Electric heaters. Temperature control was effected during the test by a Brown recording pyrometer with thermocouple immersed in the bath.

A total of 17,738 lb. net of steel, consisting mostly of 24-in. crossarm braces, but with a few castings and some small angle iron, was galvanized during the run. Energy consumption was found to be 164 kw.-hr. per net ton during the working period, or 230 kw.-hr. per ton including the overnight radiation losses. At a rate of 1¼ cents per kilowatt-hour this amounts to 14.4 cents per pound of work galvanized. Previous tests with a gas-fired tank showed an average cost as high as 27.5 cents per pound of work, indicating an actual fuel saving of 13.1 cents per pound with the electric tank.

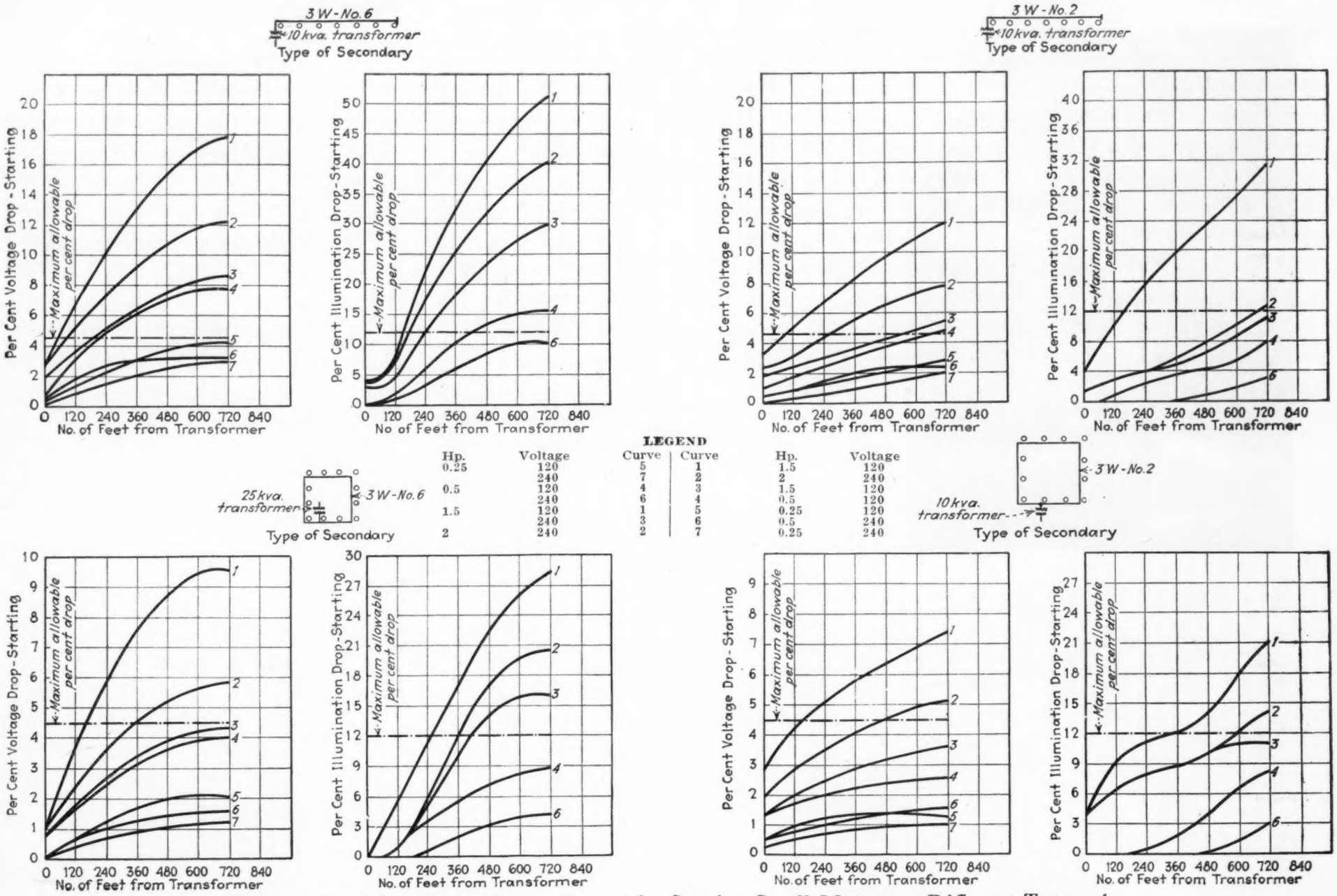
This large saving was found to be largely due to the fact that the immersion period for crossarm braces in the electric tank could be cut down from two minutes to 45 seconds. Although the tank was designed for a production of 800 lb. per hour, most of the test was run at a production rate of 1,600 lb. per hour. Varying the temperature of the Spelter bath during the test showed the optimum temperature to be 800 deg. F. with an immersion time of 45 seconds. The standard GS6 test requires that work galvanized shall stand four one-minute dips in a standard copper sulphate solution before any part of the coating is eaten through. Nine dips were required to eat through the coating on a sample immersed two minutes at 855 deg. F. This piece carried 3.04 per cent of zinc by weight, two ounces of zinc per square foot of surface and had a coat thickness of 0.003 in. The test piece immersed only 45 seconds withstood five dips and had a coating of about 0.002 in. This piece was placed in a vise and bent nearly double without any evidence of cracking or peeling of the zinc coating.

The electric tank has been in operation for several months and during this time the dross has not materially increased in the tank. Formerly, about 1,000 lb. of dross was removed from the tank each week, so that a saving of at least 3,000 lb., or $120 per month, is being made on dross alone. Working conditions are much better with the electric tank and the automatic temperature control makes it possible for the operator to give his entire time to immersion of the work. In summarizing the many advantages of the electric process it has been found that the over-all cost has been reduced to about one-half of its former value with the gas-fired bath.

Mercury-Arc Rectifiers in Railway Installations Installed or on Order Since 1927

(From report of A.I.E.E. committee on electrical machinery, W. J. Foster, chairman).

	No. of Sets	Tanks per Set	D-C. Voltage	Kw. per Set	Total Kw.	Control
Commonwealth Edison Company, Chicago, Maypole	1	1	600	3,000	3,000	Auto
Commonwealth Edison Company, Chicago, West Lawn	1	1	600	3,000	3,000	Auto
Toronto Hydro-Electric System, Toronto, Ossington	1	1	600	1,100	1,100	Auto
Southern Public Utilities Corp., Charlotte, N. C., Eliza. Ave	1	1	600	750	750	Manual
City of Calgary, Calgary, Portable	1	1	575	600	600	Auto
Union Railway of New York City, New York, St. Peters Ave	1	1	625	1,000	1,000	Auto
Toronto Hydro-Electric System	1	1	600	1,100	1,100	Auto
American Gas & Electric, New York	2	1	600	1,000	2,000	Auto
Cons. Mining & Smelting Co. of Canada, Electrolytic	3		460/560	5,600	16,800	Manual
City of Edmonton	..	..	575	....	1,325	Manual
City of Calgary	..	..	575	....	1,200	Auto
City of Halifax	1	1	600	1,100	1,100	.....
Chicago & Joliet	1	1	600	500	500	Auto
Columbus Railway, Power & Light Co	1	2	600	500	1,000	Manual
Columbus Railway, Power & Light Co	1	1	600	500	500	Auto
Columbus Railway, Power & Light Co	1	1	600	500	500	Auto
Eastern Mass St. Ry	1	2	600	1,000	3,000	Manual
Chi., So. Shore & So. Bend Ry	1	2	1,500	....	1,500	Auto
Chi., So. Shore & So. Bend Ry	1	2	1,500	....	1,500	Auto
Chi., So. Shore & So. Bend Ry	1	2	1,500	....	1,500	Auto
Philadelphia Rapid Transit	3	1	600	1,000	3,000	Auto
Sacramento Northern Railway	1	1	1,500	500	500	Auto
Piedmont & Northern	2	2	1,500	750	1,500	Auto
British Columbia Elec. Ry	1	1	600	1,000	1,000	Manual
					48,975	


3 W - No. 6
10 kva. transformer
Type of Secondary
Per Cent Voltage Drop - Starting
Per Cent Illumination Drop-Starting
Maximum allowable per cent drop
No. of Feet from Transformer
3 W - No. 2
10 kva. transformer
Type of Secondary
LEGEND
Hp. | Voltage | Curve | Curve | Hp. | Voltage
0.25 | 120 | 5 | 1 | 1.5 | 120
240 | 7 | 2 | 2 | 240
0.5 | 120 | 4 | 3 | 1.5 | 120
240 | 6 | 4 | 0.5 | 120
1.5 | 120 | 1 | 5 | 0.25 | 120
240 | 3 | 6 | 0.5 | 240
2 | 240 | 2 | 7 | 0.25 | 240
25 kva. transformer
3 W - No. 6
Type of Secondary
10 kva. transformer
3 W - No. 2
Type of Secondary

Voltage and Illumination Drops Caused by Starting Small Motors on Different Types of Isolated Secondaries Served by Different Sizes of Transformers (See also Page 375)

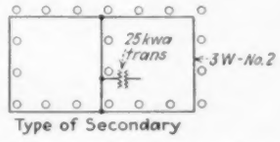
Motor-Starting Effects
on Secondaries Minimized

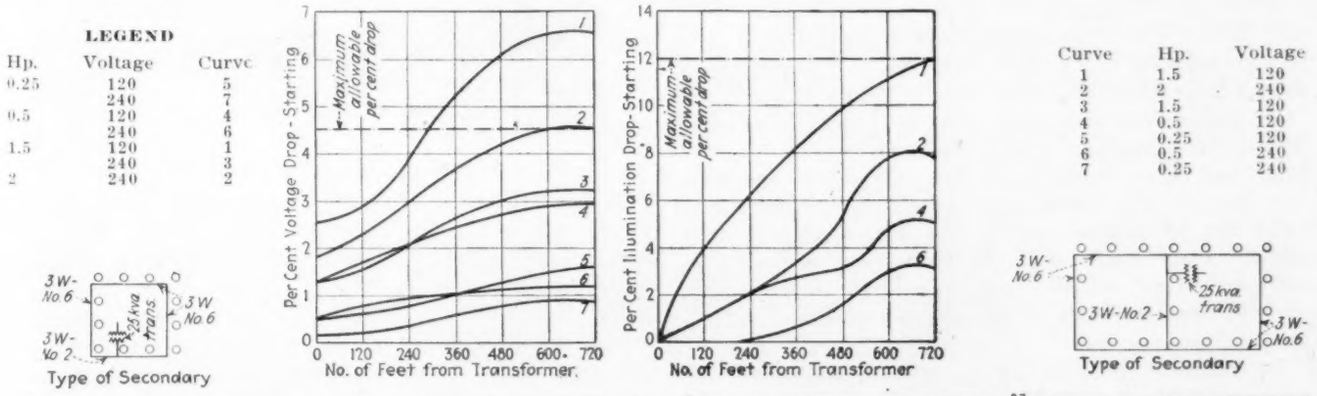
Study of voltage and illumination drops caused by starting small motors on isolated secondaries provides data by which installations may be controlled and complaints of flickering lights thus reduced

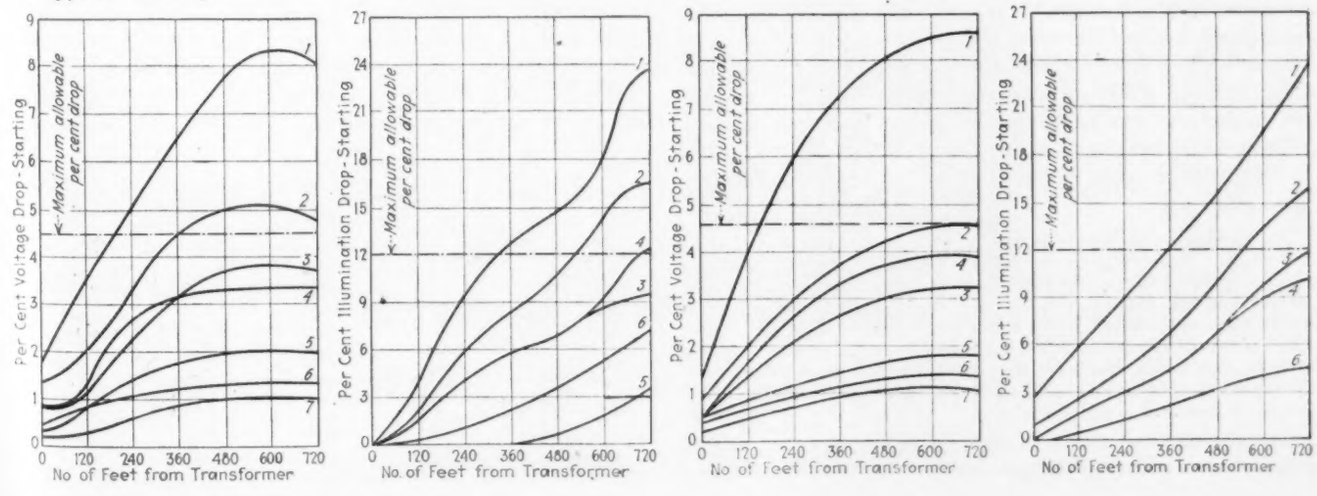
By Michael C. Abrahm
Distribution Engineering Department,
New Orleans Public Service, Inc., New Orleans, La.

COSTLY line rearrangements are sometimes necessary to remedy conditions brought about by starting of small single-phase motors, such as are rapidly increasing in use on refrigerator and other small power appliances in domestic installations. As a result of the starting current taken by these motors, a growing number of complaints of flickering lights are received by utilities. The problem is especially acute on isolated secondary systems and on bank systems in which the transformers are widely spaced or the secondary copper small in size.

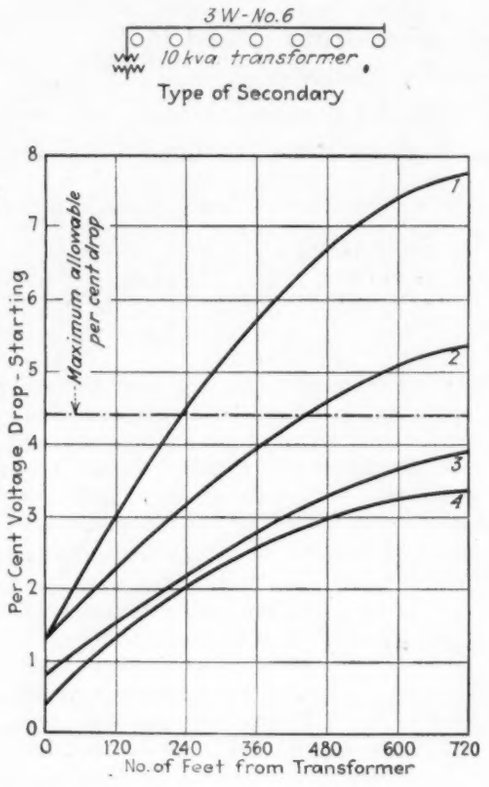
A measure of control of this problem has been reached by the New Orleans Public Service, Inc., through a study of the effects of starting currents on various types of isolated secondaries in the system. The results of these studies are incorporated in the series of curves here reproduced, which are used to determine whether or not a proposed motor installation will have an objectionable effect. If such effect is indicated provisions may easily be made to minimize it by the use of current-limiting motor-starting equipment. The study was made by actually connecting various sizes of small motors at different points on secondaries of various wire sizes and configurations. The motors used were all of a standard make repulsion start type, designed for either 110- or 220-volt service. The tests






Maximum allowable per cent drop
Per Cent Voltage Drop-Starting
Per Cent Illumination Drop-Starting
No of Feet from Transformer

were made by throwing on the motors with locked rotors and noting the voltage drops under these conditions. The illumination drop in terms of lamp performance was noted by a special instrument called a "flickometer," designed by the writer. This instrument utilizes a standard "Mazda" lamp and a foot-candle meter inclosed in a dark box which is provided with a specially designed



eye piece. The "flickometer" and voltmeter were connected between the neutral and the live conductor at each test point. The motors were first connected 110 volts and served from the same two secondary wires. Voltage (no load and load), foot-candles (no load and load) and currents were read for each motor separately. The motors were then connected 220 volts and served from the two outside conductors and similar readings taken. Data were taken at seven different points on each secondary and on seven representative secondaries of the characteristics noted in the captions for the curves.

In order to apply the curves to operating conditions tolerance limits had to be set for voltage and illumination drops. These limits were set at 4½ and 12 per cent respectively. Above these limits severe eye fatigue was experienced, while immediately below them, although the flickering was noticeable and annoying, no harmful effects could be noticed.

As an illustration of the use of the curves, let us take a specific case:

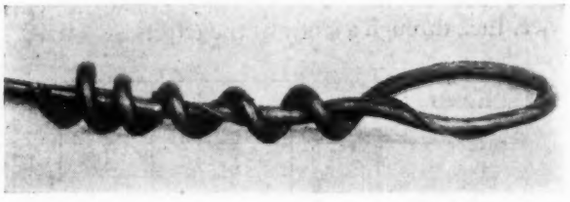
An application comes in for supply to a 1.5-hp. motor connected 220 volts. Referring to secondary maps, it is found that the service could be taken from the third pole from the nearest transformer and the secondary is a straight run of No. 2 wire. This condition is represented in the upper left corner of page 375. Three spans measure approximately 360 ft., which indicates a 3.6 per cent voltage drop below the limit line and therefore permissible. The illumination drop is shown to be 5 per cent, which is also below the limit line and permissible.

As a check on the accuracy of these curves, oscillograms were taken of several motor installations on customers' premises. From the oscillograms a set of curves showing voltage drops using resistance starters on the motors were derived. As the other curves were drawn from actual test data, discrepancies may appear between the voltage and illumination drops in comparative calculation. It is evident from the curves that as a network secondary system is approached motor-starting currents have less objectionable effects. Analysis of the curves reveals that all single-phase motors of ½ hp. and above should be connected for 220 volts, that no single-phase motor larger than 3 hp. should be connected to an isolated lighting secondary and that the size of the supply transformer should be considered in anlyzing motor-starting conditions.

36-Year-Old Wiring Tests as Good as New

SAMPLES of wire taken from an installation in the Holy Name Roman Catholic Cathedral, Chicago, made in 1893 have been subjected to physical and dielectric tests by the Okonite Company and found to possess characteristics as good as new wire. The tests were made possible by recent alterations of the Cathedral. Furthermore, there are no records of this 36-year-old installation having failed to do the work it was supposed to do and no repairs have been reported because of faulty installation.

General observations indicated that the tinning on the copper conductors was free from corrosion. Specimens of the wire were subjected to the severe bending



Specimen of 36-Year-Old Rubber-Insulated Wire Wrapped on Itself

test shown in the accompanying illustration without cracking or checking. There was no braid or covering over the rubber insulation. The insulation adhered so firmly to the conductor that difficulty was experienced in securing undamaged specimens for tensile tests.

Dielectric tests were made on 3-ft. samples in water. The results obtained were equal to the breakdown qualities of new wire having the same size and wall thickness of insulation despite 36 years exposure to light and air without a protective covering.

Dielectric and Tensile Tests on 36-Year-Old Rubber Insulation

Samples	Test	Voltage Breakdown, Kv.	Maximum Dielectric Strength (Volts per Mil.)
(a)	Rising Voltage	19.50	759
(b)	Rising Voltage	17.50	680
(c)	Rising Voltage	18.50	720
(d)	Rising Voltage	17.25	670

Samples	Tensile Strength	Elongation
(a)	213 lb. per sq.in.	2.4 in. from 2.0 in.
(b)	414	2.5
(c)	367	2.4
Average	365 lb.	2.5 in.

Economies of Firing Stained Glass Electrically

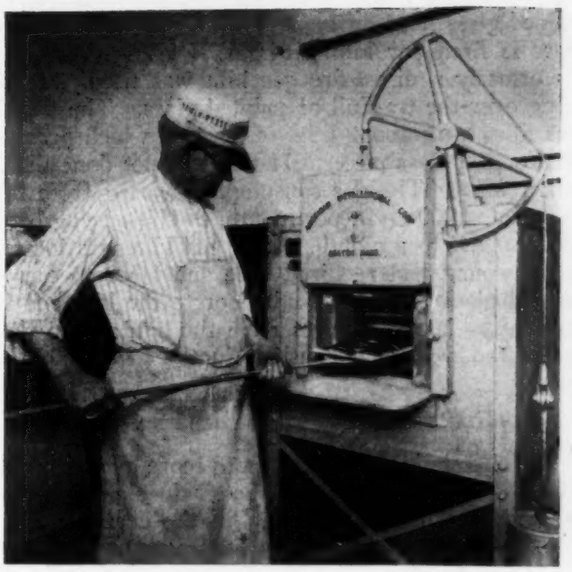
1.9 sq.ft. of glass fired per kilowatt-hour. Quality improved and rejects reduced to the minimum

By P. N. Rugg
Industrial Heating Division
Edison Electric Illuminating Company of Boston

SINCE March, 1929, stained glass has been "fired" by electric heat in the studio of Earl E. Sanborn, Boston, Mass., a 15-kw., 220-volt, box type furnace being employed with marked advantages in quality of product, improved working conditions and a more than doubled volume of output compared with the former gas-fired installation. The interior dimensions of the kiln give an effective hearth area of 12 in. wide by 24 in. long, with a door opening of 11 in. As the maximum temperature used is 1,200 deg. F., the radiation loss at that temperature is about 2.5 kw.

An alloy rack provided with supports to hold a maximum of ten "X-ite" plates is located in the furnace chamber. The X-ite plates weigh 8 lb. each and are 10 in. wide by 12 in. long. Five shelves with two plates per shelf constitute a fully charged kiln. This represents an effective area of 1,200 sq.in. available for firing glass. Approximately 7.5 sq.ft. of glass is fired at one time.

If the glass is subjected to a sudden change in temperature, stresses set up cause the glass to crack and break. This condition is experienced when the glass is charged directly from the room at 70 deg. F. into the kiln at a firing temperature of 1,200 deg. F., and also when the fired glass is withdrawn from the hot chamber to the room. By providing a second chamber at one side of the kiln the glass is preheated to about 600 deg. F. before charging into the kiln. And, similarly, the fired glass is properly annealed in an adjoining cooling chamber. This auxiliary chamber is equipped with ten 500-watt General Electric strip heaters operating on 220 volts. Five of the strip heaters are in the preheating section and five in the cooling section of the chamber. These heating units are operated by five snap switches so that the chamber temperatures may be adjusted as desired.

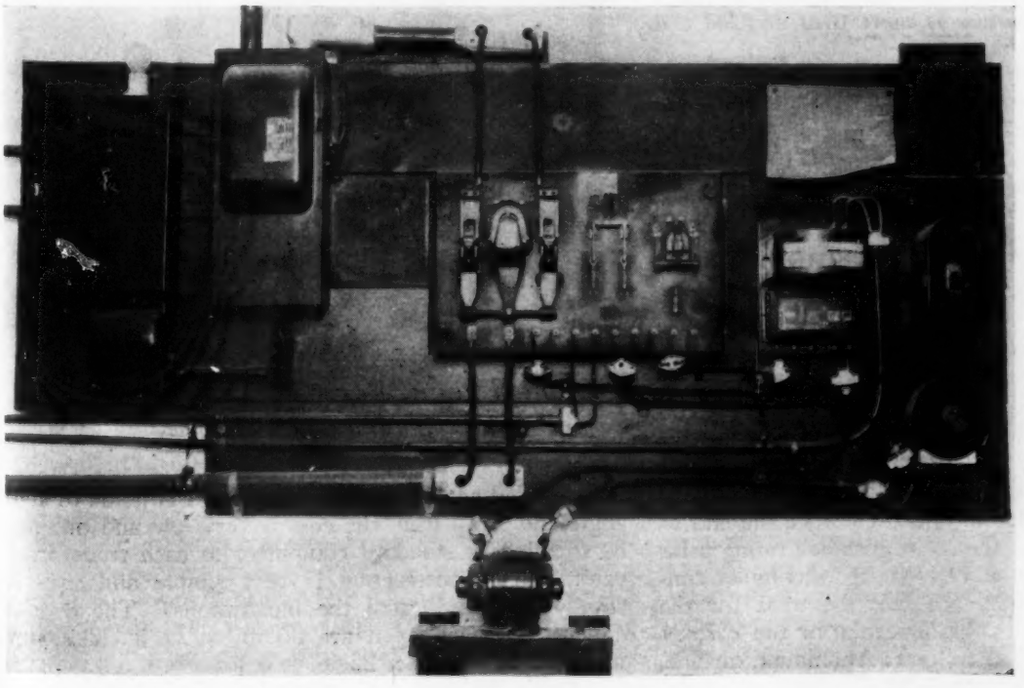


Stained Glass Firing Increased 150 per Cent in Volume by Electric Heating Over Gas

An automatic time switch turns the current on the kiln about an hour before it is desired to use it. The glass is fired in for about fifteen or twenty minutes, the length of time depending on the colors being fired. During the transfer to and from the auxiliary chambers the hot "X-ite" plates keep the glass from cracking while it is subjected to the room temperature.

After cooling overnight the temperature of the kiln is about 800 deg. F.

Approximately fifteen firing cycles are completed dur-



Control Panel for Electrically Heated Kiln

The Brown indicating controlling pyrometer used contains an a.c. motor, so that a rotary converter is necessary. This is shown on the stand below the panel. A Tork automatic time switch is shown directly above the rheostat, and is used with the converter and controlling instrument.

ing the day, giving a production of about 112 sq.ft. of stained glass fired during this time. About 1.9 sq.ft. of glass is fired per kilowatt-hour.

Formerly a direct-fire gas kiln was used, the flames being over the trayfull of painted glass. The tray used was filled with about 1 in. of plaster, which provided a bed for the glass pieces. If this was not done the glass would warp. The gas consumption varied from 28,000 cu.ft. to 40,000 cu.ft. per month, the bills being between $35 and $45 per month. This gas kiln was located in the basement and required time and labor to carry the painted glass from the sixth floor to the kiln and back. Due to the large heat loss from the kiln and to the gas fumes the working conditions in the firing room were poor.

Electric Heating Increases Output

The electric kiln fires 2.5 times more glass per charge than the gas kiln, is much better insulated thermally, has uniform heat distribution in the chamber and the temperature is automatically controlled. This kiln is located in the studio itself. Rejects due to poor firing are eliminated, as the paint is fused with the glass perfectly, there being no bubbling, spitting or running of the paint. Tests on glass fired in the electric kiln show that the firing withstands the "scratch" test. The color shading before and after firing being the same, the result is ideal. This could not be realized with the gas-fired kiln because the moisture is evaporated from the paint due to the presence of the flame and draft. Losses due to cracked glass caused by high flame temperature are also eliminated by electric heating.

The glass, which is imported from England, is worth about $200 per charge in the kiln. This is because of the time and labor required to draw the design and to cut, shape and paint the glass. Consequently, rejects due to poor firing or cracked glass mean a considerable loss.

Production Doubled, Rejects Reduced

Electricity for heating the kiln costs 3 cents per kilowatt-hour and a typical energy consumption per month is approximately 1,500 kw.-hr. The kiln is operated 5½ days a week on its regular operating cycle. Operating costs are practically the same as for the gas-fired kiln, but the production is more than doubled and rejects are reduced to a minimum.

Installed, the kiln, auxiliary chamber and control board and wiring cost approximately $1,800. This figure includes the alloy rack, "X-ite" plates and alloy charging fork. The American Electric Furnace Corporation, Boston, supplied the kiln.

Water Power and Transmission in Austria

THAT the development of water-power resources in Austria has been proceeding vigorously during the past decade, despite the extreme depression and the collapse of the country's financial structure following the war, is made evident by statistics in the May 15, 1929, issue of *Die Wasserwirtschaft*.

The developments put into operation since the end of 1918, 379,422 hp., exceed the entire installed rating prior to that period. In addition, 484,010 hp. was under construction January 1, 1929, bringing the total for the country to 1,191,502 hp. The allocation of the 237,491 hp. in industrial plants is as follows: Aluminum, carbide, ferrosilicon and other chemical products, 67,744 hp.; wood, pulp and paper, 74,866; mining, machinery and metal industries, 58,055; construction materials, glass and glassware, 10,500, and textiles, 26,326.

Hydraulic Horsepower Installed in Austria

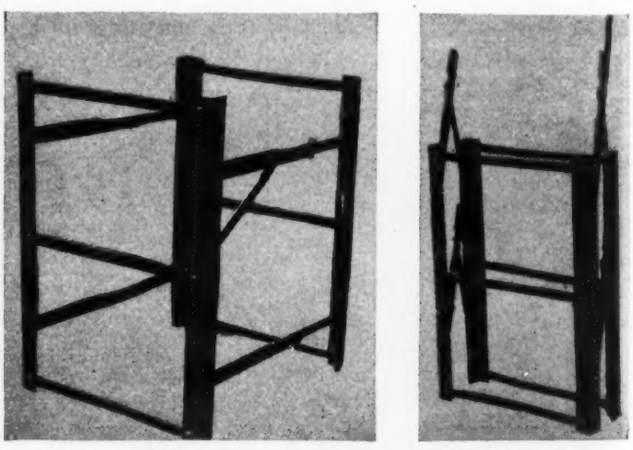
	Central Stations	Railroad Plants	Industrial	Totals
A End 1928	144,274	16,800	166,996	320,070
B Installed 1919-1928	295,117	32,000	52,305	379,422
C Under construction January 1, 1929	397,820	68,000	18,190	484,010
Total since 1918 (*A*+*B*)	692,937	100,000	70,495	863,432
Total (*A*+*B*+*C*)	837,211	116,800	237,491	1,191,502

Approximately half of the 11,487 km. of transmission lines completed or under construction January 1, 1929, was for operation at 10 kv. or less; a little more than one-quarter was for 10-20 kv.; about 10 per cent for 20-40 kv., and the remainder for higher voltages. Fully 75 per cent of this transmission was constructed after 1919.

A Collapsible Manhole Guard

By Carl W. Evans
Underground Distribution Engineer
San Antonio Public Service Company

WITH the advent of network systems and the increase in the frequency of inspection of underground equipment and cables, the problem of protecting manhole and vault openings is receiving added attention. As a general rule, the inspector has a great deal of testing equipment and miscellaneous tools to carry from place to place and the added burden of a manhole guard does much to slow up the testing routine. The accompanying illustrations show two views of a collapsible guard which may be folded and dropped into a manhole, hung upon a suitable hook or support, and left there until needed again. Because the guard is made of light angle and strap iron, the cost is very low and one may be supplied as standard equipment to each transformer vault. The construction is very simple and may be readily discerned from the illustrations. The over-all dimensions when open are 36 in. x 24 in. x 22 in.; when closed 46 in. x 22 in. x 6 in.



Light-Weight, Low-Cost Manhole Guard Extended and Collapsed

Railroad Requirements in Purchasing Power

By G. I. Wright
Engineer Electric Traction, Reading Company

WHERE the power company adopts a policy of mutual co-operation, desire to serve, willingness to make the necessary investment to supply the power in the form and at the locations desired by the railroad and will supply this power at fair cost there is no longer a question as to the railroad obtaining satisfaction from purchased power. Although generation by the railroad in a modern plant of its own is considered satisfactory as to reliability, power purchased from a modern public utility system, with its multiplicity of interconnected sources of supply, is in general superior as to reliability to that generated by a railroad.

Electrification, except in special cases, must justify itself economically. Due to the large investment required by the railroad this is a difficult matter. As one of the chief operating costs is that for power, it is imperative that this be secured at a reasonable cost. In order to obtain this load, an admittedly advantageous one, in increasing amounts, the public utilities must co-operate and sell the power at the lowest possible cost. Fortunately, our most forward-looking utilities seem willing to do this.

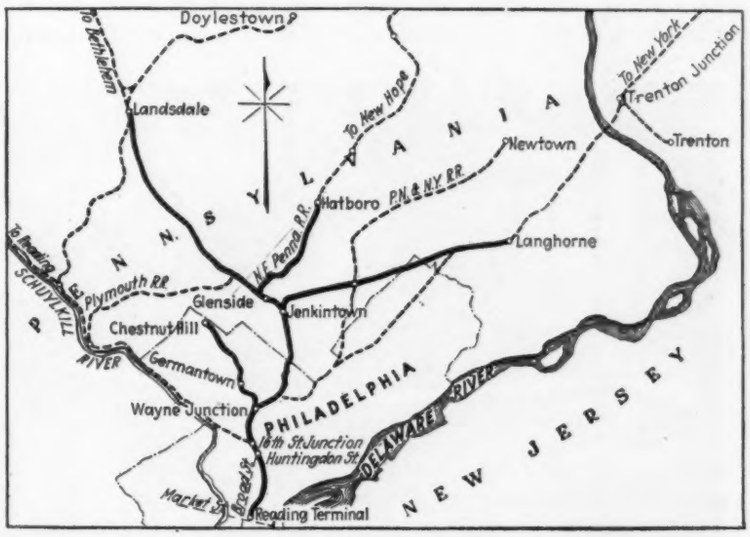
Whether the railroad uses either alternating or direct current for the operation of its trains, there will be large investment necessary in frequency changer or converter substations, which will in general be for the exclusive use of the railroad. In a recent large suburban electrification this amounted to $2,600,000, and in the Reading's case will amount initially to $1,500,000. This investment, as well as that for generation and transmission, should be borne by the power company for the following reasons:

1. It is assured of receiving an adequate return on the investment, as its demand charge is made up for that very purpose. This is a fundamental of the power company's rate structure for all customers, large and small, which it is felt is largely responsible for their unprecedented growth and financial success. The railroads are not so fortunate, as their rates are fixed without any reference to investment necessary to serve, and in addition they are faced with governmental recapture of earnings when these exceed 6 per cent.

2. It is easier for the power companies to obtain the necessary capital and they probably can secure this at a lower rate of interest.

In order to protect the power company for amortization and depreciation of the equipment provided exclusively for railroad use a contract should be for a sufficient term, say twenty years, to do this. We feel, however, in agreeing to this we should in turn be assured of sharing in the benefit of probable future reduced power costs. The history of the public utility industry has been one of continuously increasing efficiency, which, with interconnection of plants and systems, has resulted in a steady decrease in power costs. There is always the possibility of new inventions or processes, at present unthought of, causing further reductions. This result can be obtained by having the contract on a cost basis for everything entering into the cost of delivering power.

Such contracts will have far-reaching effects on co-operation between the supply company and the purchaser. It will discourage arbitrary requirements on the part of railroads when they can be shown that such requirements will increase the cost of power. It will encourage the joint use of facilities and the railroads will benefit by the effect on the cost of diversity of loads and the joint use of spare capacity. If a frequency changer station or a converter substation can be located so as conveniently to serve two railroads there is no more reason why they cannot satisfactorily obtain power from the same bus in such a station as from the same generating station bus. A recent example of co-operation and joint use of facilities is the use of the Reading Company's right-of-way for the Philadelphia Electric Company's high-tension transmission lines bringing all power from Conowingo into Philadelphia. All the problems in connection with this project have been worked out to the mutual satisfaction of the two parties concerned.



Sections of Reading Being Electrified

Work is progressing on the electrification of the sections emphasized, which involve 110 miles of track. According to Agnew T. Dice, president, the electrification will permit about 25 per cent daily increase in service with a saving of 20 to 25 per cent in time compared with steam-train schedules. Negotiations are still under way for purchase of power, to be used in the form of 11,000-volt, single-phase energy.

General Principles

The railroad should not be penalized in the power contract for the demands in excess of the normal every-day traffic requirements. The power company installs capacity for these normal demands and certain spare capacity for breakdowns. As the abnormal demands do not increase the investment or fixed charges they should not be charged for. The fairness of this is now generally recognized, but what constitutes abnormal demands varies in different contracts.

Any contract should be broad enough to take care of the power supply for the entire electrification, no matter how far this should be extended, presuming this should prove desirable. It should also be broad enough to cover interconnection and interchange of power with other connecting railroads and other sources of power supply.

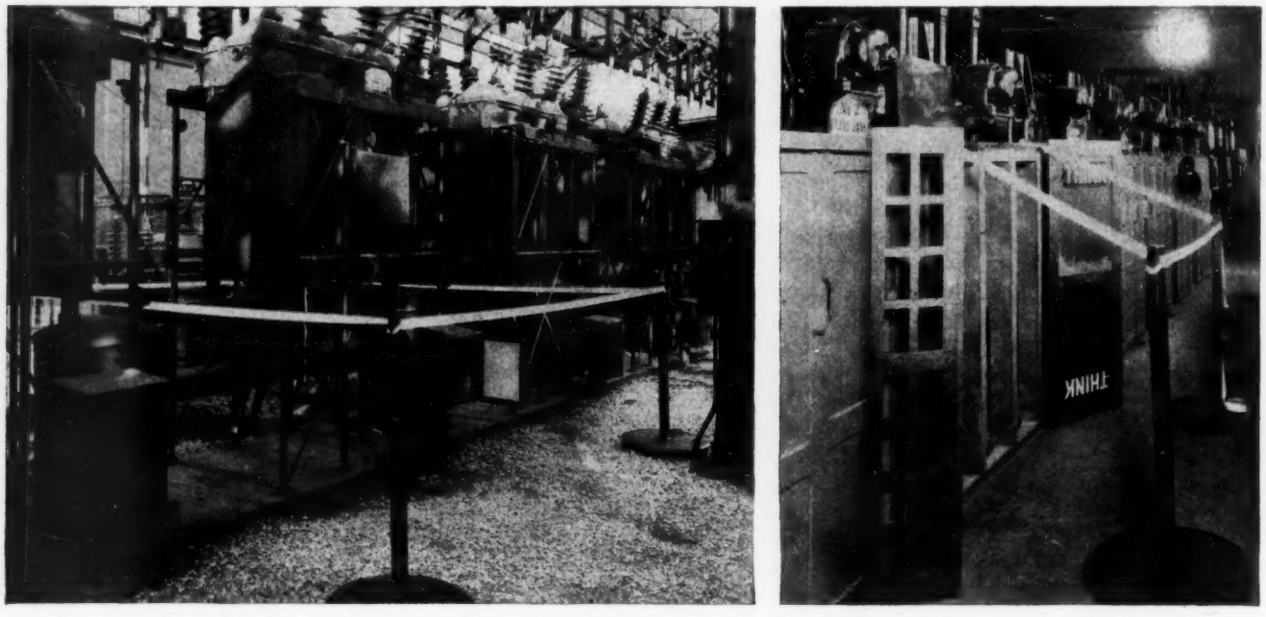
Safety Equipment in Substations

By H. P. Sleeper
Protection Engineer Public Service Electric & Gas Company, Newark, N. J.

AN ANALYSIS was recently made by the safety committee of the Public Service Electric & Gas Company to determine the cause of accidents in substations. This particularly referred to accidents wherein men are injured by contact with energized electrical equipment. This survey proved that the majority of such accidents were due to the workmen being unable readily and quickly to identify the dead equipment from the live equipment of similar character in a nearby location. Several accidents were found to have occurred where a workman would stop work on a piece of equipment which was out of service during noon hour or to secure tools or equipment not at hand. When the workman returned he would begin work on an adjacent piece of equipment of similar appearance which was in service and injury would result.

Obviously the means of preventing this type of accident is to identify positively and prominently this kind of equipment which is out of service for work. The equipment worked out by the safety committee consisted of a set of standards, to be placed around the equipment out of service, and a quantity of white tape to be placed between the standards completely to surround equipment being worked on, as shown in the accompanying illustrations applied to an outdoor breaker installation. When used on indoor equipment the same device may be used if convenient, but in addition to or in lieu of the standards, if impossible to use the latter, a set of barriers is shown in use in the right-hand illustration. These barriers are placed on either side of the compartment being worked in, to identify the proper compartments. Prominent signs which indicate that the equipment is cleared and tagged for work are placed at proper locations around the taped-in inclosure further to identify the dead equipment.

Several months' use of the above safety devices indicates that they give the desired result, and in general the workmen are much in favor of their use as a protective measure.



White Tape on Standards Surrounds Equipment to Be Serviced. Barriers May Be Used Instead of Standards to Protect Workers

Electric Milk Cooler Saves More than Its Cost in a Year

AN ANNUAL operating cost reduction of $1,475 accomplished by an electrically refrigerated milk cooler for which he paid $860 is claimed by Louis B. Flynn, Winchester, Ky., as reported by F. J. St. John in the August, 1929, issue of the *Dairy Farmer*. Before he put in the electric cooler it cost Mr. Flynn $1,715 per year to chill the milk from his dairy. Of this amount $720 was for ice, $156 for labor in cracking and packing, $803 for spoilage and $36 for pasteurization. With electric refrigeration, the annual cost is $240, of which $102 is for electric current and $138 for interest and depreciation on the $860 investment. The items of spoilage and pasteurization are eliminated entirely on account of the lower temperature attained, which is 35 deg. for the electric installation, as against 50 deg. with ice.

The savings above enumerated are only those that are capable of easy evaluation. Increased storage facilities in the new equipment permit the accumulation of cream and the manufacture of cottage cheese. This is a new line added to the product sold and is a direct increase in the volume of business. The low temperature keeps the bacteria count in the milk at a very low figure, thus removing the necessity for pasteurization and permitting the distribution of a high-grade unpasteurized milk, which the customers of the dairy like much better than that which they had been receiving. The saving of time is also an important factor. The milk can be put through the cooler as rapidly as it is taken from the cows; in fact, is doing the work in half the time that was required with ice.

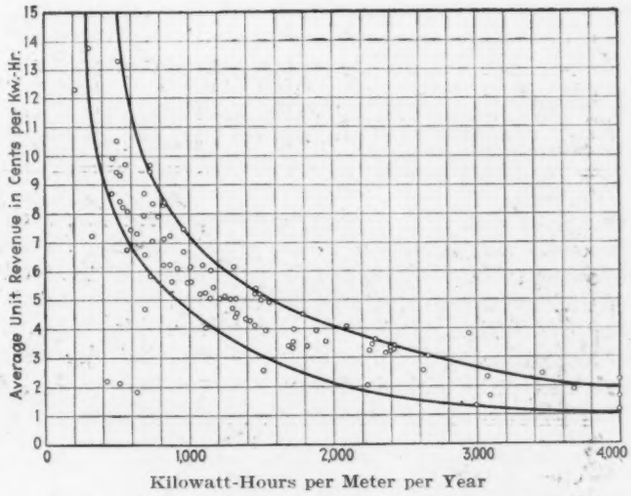
Expenses and Sales
per Customer

Analysis of Eastern utilities shows a fairly fixed unit cost per consumer served. Commercial and new-business accounts compared

By Robert Teviot Livingston
Assistant Professor of Mechanical Engineering Columbia University

IN THE previous article of this series all costs were calculated on a bases of ratio to revenue or cents per kilowatt-hour. It was found that in most cases the spread was very wide and many of the results obtained were inconclusive. In order to obtain some measure which is more definite and less uncertain the various costs were divided by the number of customers in order to obtain a unit cost per customer, and in most cases there was found to be less variation. The preferred positions were often found to be quite definite. The results obtained are presented in tabular form. Production, transmission and utilization costs are not presented; in the latter two cases it was tried, but the results obtained were useless and so are not here presented. In fact, there seems to be no logical reason why these particular costs should bear any direct or close relation to the number of customers. In the case of distribution costs, however, the annual unit costs seem quite definite even though there were many which ran much higher than the $5.40 limit which is placed in the table. As mentioned before, it seems apparent that those companies with underground distribution will run on the upper limit of this range, while the overhead distribution will usually be lower, though in this connection every individual company is a problem in itself and general conclusions are of doubtful value.

The logic of comparing commercial and new-business accounts on this basis is obvious. In general, the cost of reading the meters, bookkeeping, billing, postage and collecting is directly dependent upon the number of customers. Variation will be found to depend upon the density of the customers, the number of different offices run and the general characteristics of the community served. On the other hand, there is no real reason why the general and miscellaneous costs should have any dependence upon the number of customers, and this is particularly true if the retirement expense is included in the general and miscellaneous cost. The unit costs are here presented because the other means of comparison yielded uncertain results. As is to be expected, the unit retirement expense is the highest for hydro companies.



Sales per Customer Exclusive of Sales to Other Public Utilities

An additional unit cost is here presented, the fixed capital per customer. In view of the fact that the average customer has about the same connected load and the same distribution equipment it is reasonable to expect that this ratio would be fairly definite and of value. It is seen that the hydro company has the greatest investment per customer, while as the company purchasing its energy has the least. In the latter case the investment is all in transmission and distribution equipment. If this figure is subtracted from the steam and hydro costs it is seen that investment costs of $75 and $150 a customer result, and this checks with the generally accepted view that a hydro plant costs at least twice as much per kilowatt capacity as a steam plant.

Unit costs alone do not tell the whole story of a system operation; losses also are important. A generating station may produce electricity for a very low figure per kilowatt-hour generated, but if a large per-

Cost per Customer

Account	No. of Cases	Preferred Position	Range
Distribution	125	$4.50	$2.40- $5.40
Commercial	117	2.00	1.60- 2.60
New-business	102	.80	.20- 1.40
Commercial and new-business	121	3.50	1.50- 4.00
General and miscellaneous	110	12.00	9.00- 15.00
Retirement all customers	99	4.00	2.50- 5.00
Hydro	27	4.50	
Steam	21		3.50- 5.00
Purchasing	51	3.50	2.50- 5.00
General and miscellaneous retirement	126	8.00	3.00- 12.00
Fixed capital—all companies	123	225.00	100.00-400.00
Hydro	39	300.00	150.00-400.00
Steam	23	225.00	150.00-350.00
Purchasing	59	150.00	100.00-250.00

Output and Distribution Analysis of Representative Group of Power and Light Companies

	Hydro	Steam	Purchase	Combined
No. of customers	29,500	36,500	40,000	38,000
Kilowatt-hours sold	20,200,000	24 000,000	27,600,000	26,000,000
Production	$210,000	$439,000	$677,000	$550,000
Transmission	14,000	18,000	22,000	20,000
Distribution	112,000	127,000	140,000	130,000
Utilization	16,000	20,000	26,000	23,000
	352,000	599,000	865,000	723,000
Commercial	60,000	71,000	90,000	80,000
New-business	18,000	20,000	25,000	22,000
	430,000	690,000	980,000	825,000
General and miscellaneous	185,000	200,000	240,000	220,000
Retirement	170,000	160,000	150,000	155,000
	785,000	1,050,000	1,370,000	1,200,000
Production ratio, per cent	13.00	22.60	30.60	26.50
Transmission ratio, per cent	0.86	0.94	0.99	0.96
Distribution ratio, per cent	6.91	6.61	6.32	6.25
Utilization ratio, per cent	0.99	1.04	1.07	1.11
Commercial ratio, per cent	3.71	3.70	4.06	3.85
New-business ratio, per cent	1.11	1.04	1.13	1.06
General and miscellaneous ratio, per cent	11.41	10.40	10.80	10.60
Retirement ratio, per cent	10.50	8.32	6.79	7.45
Distribution cost per customer	$3.80	$3.48	$3.50	$3.42
Commercial cost per customer	2.03	1.95	2.25	2.10
New-business cost per customer	0.61	0.55	0.62	0.58
General and miscellaneous cost per customer	6.26	5.45	6.00	5.80
Retirement cost per customer	5.76	4.40	3.75	4.09
Kilowatt-hours sold per customer	685	658	691	685
Fixed capital per customer	$304	$233	$227	$237
Retirement to fixed capital, per cent	1.89	1.88	1.65	1.72
Average revenue, cents	8.00	8.00	8.00	8.00

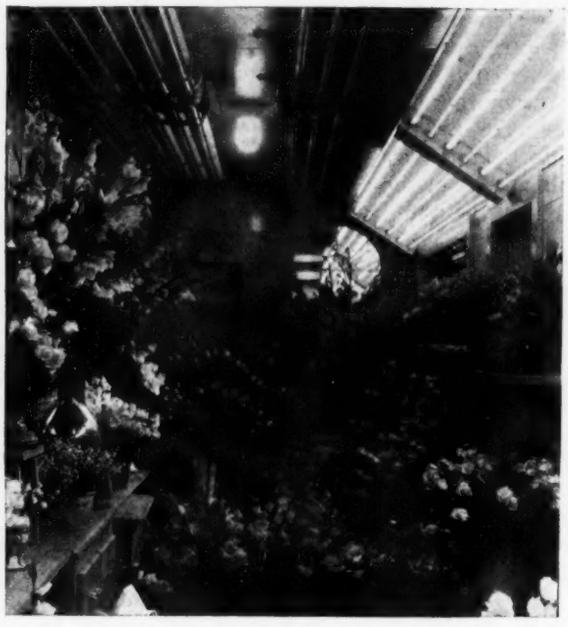
centage of electricity is lost or unaccounted for, such economies may disappear in the greater losses. In the following table are presented the percentages of the total electricity sold to that generated or bought and it measures the lost, used and accounted for. Not only are the companies analyzed in the usual basis but also on a basis of type of business done:

Class	Number	Preferred Position, Per Cent	Range, Per Cent
All companies	125	82.5	74- 90
Hydro companies	40	....	82- 94
Steam companies	58	85.0	78- 89
Purchasing companies	23	....	76- 90
Companies doing mainly lighting business	64	80.0	74- 88
Companies doing mainly power business	42	84.0	78- 92
Companies doing mainly wholesale business	12	94.0	90-100

The last three classifications really tell more than the first four, but the two together enable one to judge fairly well as to how conditions are in any specific company.

Probably one of the most important things in utility operation, and a factor which is occupying the attention of the industry at present, is the amount of electricity sold per meter. The industry as a whole is bending every effort to increase this. The accompanying illustration shows the sales per meter plotted against average unit revenue for all classes of sales except sales to other utilities and railroad corporations and includes municipal sales and power sales. The two curves presented include practically all the cases and any specific company should fall between them. The domestic sales per meter were also separately plotted against average domestic revenue. Such a curve would indicate what might be termed best practice, omitting some few companies which would be termed "sports." The value for any revenue would indicate a "par" or "bogey" and the nearness with which any individual company approaches this figure is an indication of how well a community is sold. Such a curve, plotted for a number of years, shows no change apparently. Decreases of revenue merely increase the sales per meter to a point where the revenue per meter remains about the same. The curve on page 381, when calculated for a period of years, shows an actually lowering upper limit which is indicative of the fact that the new customers taken on by the utilities are of the non-paying type. That is to say, the sales per meter are smaller than the average which existed before, and hence these added companies decrease the general average of sales per meter. In calculating the number of domestic meters when the differentiation was not given in the public service commission reports it was assumed that 85 per cent of the meters were domestic meters. In the last two tabulations are presented typical expense accounts for the four ten-million-dollar utilities which were presented in the second article of this series. The figures used were obtained by the use of the various ratios and costs which are given in the last two articles and the final tabulation shows the computed values of these same ratios and costs so that it may be seen how impossible it is for any one company to fulfill all the requirements set up in these ratios.

Florist Limits Refrigeration by Neon Lighting



THREE red and three blue neon tube lights installed in the refrigerated show window of Rosaia Brothers, Seattle, Wash., florists, eliminated the difficulties previously experienced in lighting the display space. But for the use of this type of service it would have been necessary either to increase refrigeration capacity or to reduce the lighting intensity. Color shadings of the flowers are brought out and intensified and so satisfactory are the results that the installation is allowed to burn continuously.

Electric Service Is General in Iowa

OF THE 921 cities and towns in Iowa, with a population of 1,402,690, electric service exists in 896 with 1,399,454 population, according to the results of a survey of the electric light and power industry in Iowa recently published by Joe Carmichael, director of the Iowa Committee on Public Utility Information.

Only 25 towns do not have electric service and their average population is less than 130. Of the total urban population, 99.7 per cent is in communities having electric service.

Farms served by central stations are stated to number 13,817; those served by individual farm-lighting plants 14,000. The electrification of farms in Iowa is stated to be proceeding as rapidly as this service can be made to pay for itself. More rapid strides are expected during the next few years.

For each of the 896 communities, listed alphabetically, the report gives the population and the name of the company providing electric service.

Industry Needs the Small Manufacturer

Produces large proportion of nation's output. Can keep his place in the sun by competing in service rather than in price

MASS production and consolidation, according to a popular fallacy, have swept the small manufacturer out of business in America. He is unable to compete, it is alleged, with the larger producer who has ample capital and credit facilities. In a few industries, more particularly in distribution than production, this is undoubtedly true to a degree, but in the great majority of manufacturing lines it is disproved by an examination of the facts. Not only is the small manufacturer in such industries as electrical equipment still in business but he has a definite function to perform, and there is ample evidence that this will continue to be the case.

Notwithstanding the present enormous proportions of mass production and the continuous growth of mammoth industrial concerns for which America is famous the small scale manufacturers of America are making an enormous contribution to the nation's manufactured goods. That large numbers of Americans are today realizing their ambition to go "on their own" is indicated by the latest complete federal Census of Manufactures, showing nearly 90,000 small manufacturers, employing six wage earners or less; it also shows that the next smallest class, employing from six to twenty wage earners, gained about 10 per cent since 1914. An interesting substantiation of this claim is presented by Professor Willard L. Thorp of Amherst College in a chapter on the changing structure of industry, one of the several studies included in the President's "Recent Economic Changes," a comprehensive study of economic conditions throughout the country.

The electrical manufacturing industry provides ample evidence of the importance of the smaller producer. Reference to electrical equipment and appliances immediately calls to mind one of the five or ten large nationally known producers. But the 1927 Census of Manufactures shows that there were at that time 1,777 establishments in the field. These manufacturers collectively had an output of $1,637,307,035. For the same year sales reported by ten of the largest producers whose statements are available to the public were as shown in the accompanying table.

The ten leading concerns shown have total sales of but 58 per cent of the nation's total, and even this percentage is over the mark, since all the products of the companies named would not be included in the electrical list of the Department of Commerce.

Sales of Ten Electrical Leaders

General Electric Company	$312,603,772
Western Electric Company	253,724,013
Westinghouse Electric & Manufacturing Company	185,543,087
Radio Corporation of America	56,651,658
Electric Storage Battery Company	45,640,291
Fairbanks Morse Company	28,391,416
Maytag Company	25,582,684
Kelvinator Corporation	20,122,865
Eureka Vacuum Cleaner	12,780,161
Cutler-Hammer Manufacturing Company	9,345,156
Total	$950,385,103

In the findings of Professor Thorp, above referred to, there are situations in which small-scale production is more effective or even necessary. "At any given time in any given phase of the industrial art there appears to be a size of plant which is most efficient. Technical improvements change relationship between the cost of capital and of labor. Altered markets may all serve to change this figure."

Some Advantages of Smallness

What are some of the advantages of small manufacturing plants? Theoretically, in many cases, the overhead of the small producer is relatively low. He is fairly familiar with details of cost, and only naturally is careful of small expenses, especially when he has a large investment in his own business. It is very probable that he is more observant of small waste. It is claimed by many that the small manufacturer is closer to his labor and gets better results in this way than the big concern frequently gets from its many employee-service policies.

Another advantage often claimed for the small manufacturing plant is that it can cater more closely to the specific needs of its clients. The large producer usually cannot interrupt the production process to serve the needs of individual buyers to the extent that the small man can. In this manner, rather than by attempting to cut prices, the small man is frequently able to compete with the much larger producer.

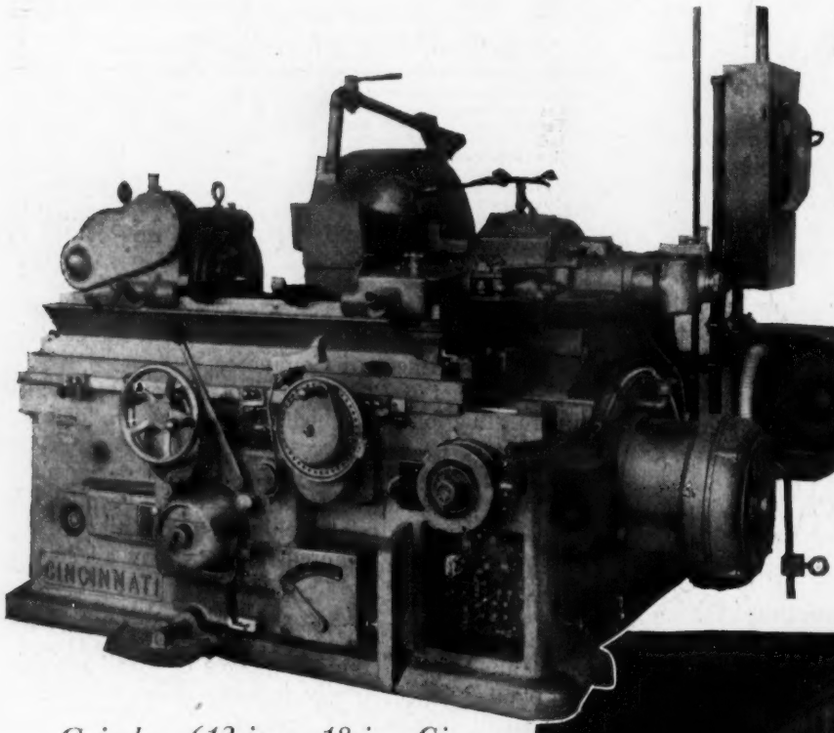
It is also claimed that there is more direct and intimate dealing in the case of the small producer. Many buyers prefer to deal with an important officer of a small organization rather than a smaller man in a large one. It is sometimes felt that more personal service is thus secured, and there is the assumption that when dealing with one of the principals or heads of a business one is dealing with a responsible party. Another important advantage claimed for the small manufacturer is the ease with which he initiates changes of equipment throughout his plant arising out of any new patent or development. In this way it is sometimes possible for the small man to cater more quickly to the needs of his clients.

Notwithstanding these claims, it is obvious that the smaller units of business are daily growing larger, while the leaders also are also increasing in size. The argument is not an attempt to show that the smaller manufacturer produces better goods than the larger producer, but merely that there is a place in production for the small manufacturer, even with our twentieth century mass production processes.

Another fact that should not be discounted is that new uses for electricity occur each year and that new electrical devices are introduced frequently. Under these conditions groups of small manufacturers will be added frequently because of the logical and economical development of new devices on a commercial scale.

Some Examples of

Modern Mac



Photos courtesy of Westinghouse Electric & Manufacturing Company.

Grinder (12-in. x 18-in. Cincinnati Plunger-Cut, with 7-in. Wheel)

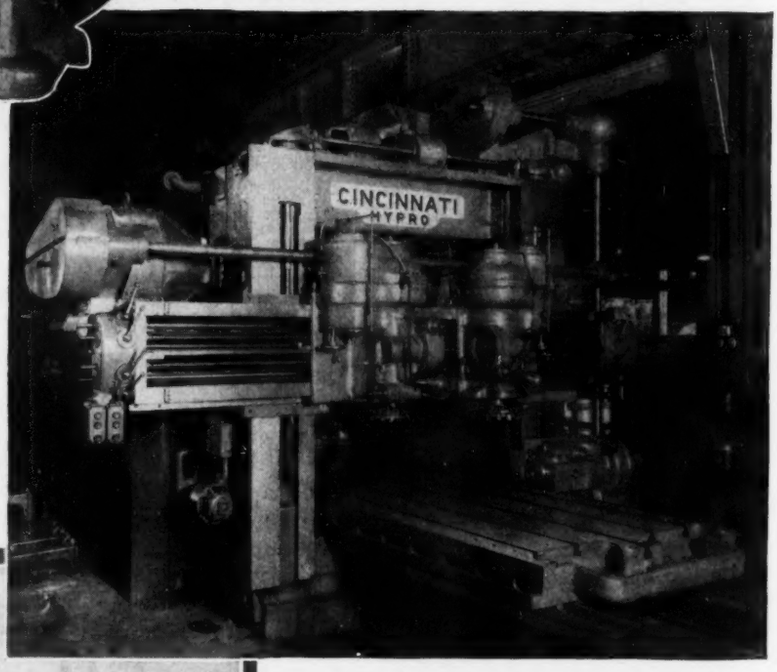
Main Drive—32-hp., squirrel-cage, flange-type, ball-bearing, 1,450-r.p.m., two-phase, 25-cycle, 220-volt motor with four-pole auto starter and "stop" button.

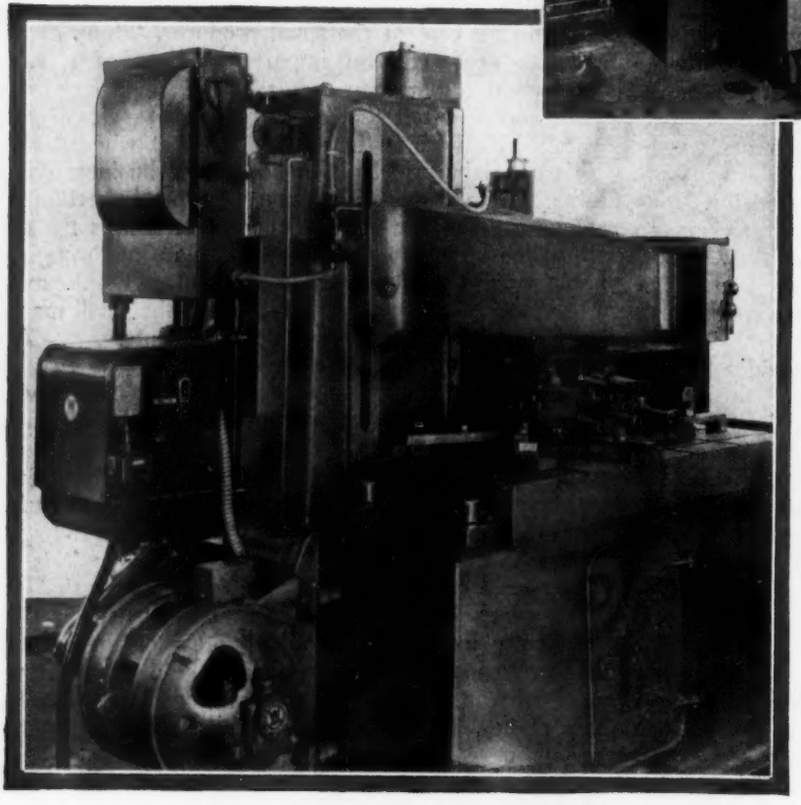
Headstock Motor — 1½-hp., adjustable-speed (550-2,200-r.p.m.), 230-volt motor with magnetic controller.

Infeed and Crossfeed Drive—¼-hp., adjustable-speed (900-2,700-r.p.m.), 230-volt direct-current motor with three-point starter.

Open-Side Shaper-Planer (Rockford 36-in.)

Driven by 10-hp., 220-volt, two-phase, 25-cycle, 1,450-r.p.m., squirrel-cage motor with four-pole automatic starter and push-button "stop."





Planer Type Milling Machine (60-in. x 48-in. x 14-ft. Cincinnati Hypro)

Vertical Spindle Drives (2)—20-hp., adjustable-speed (400-1,600-r.p.m.) motor with magnetic controller for reversing and dynamic braking.

Horizontal Spindle Drives (1) — 10-hp., adjustable-speed (400-1,600-r.p.m.) motor with magnetic controller for reversing and dynamic braking.

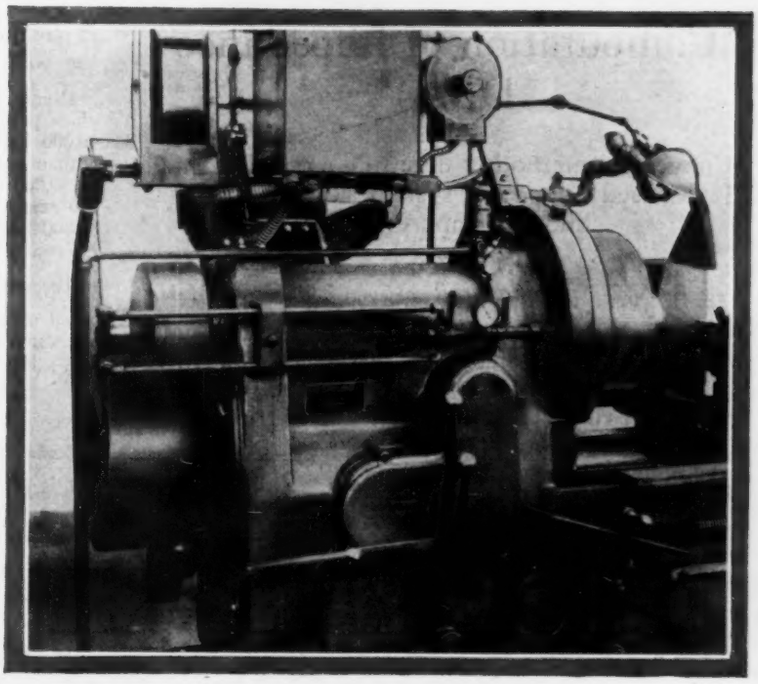
Platen Drive — 10-hp., adjustable-speed (400-1,600-r.p.m.) motor with magnetic controller for reversing and dynamic braking.

Cross-Rail Drive — 5-hp., constant-speed (1,150-r.p.m.) motor with magnetic controller for reversing and dynamic braking.

Pump Drive—1-hp., constant-speed (1,140-r.p.m.) motor with magnetic controller.

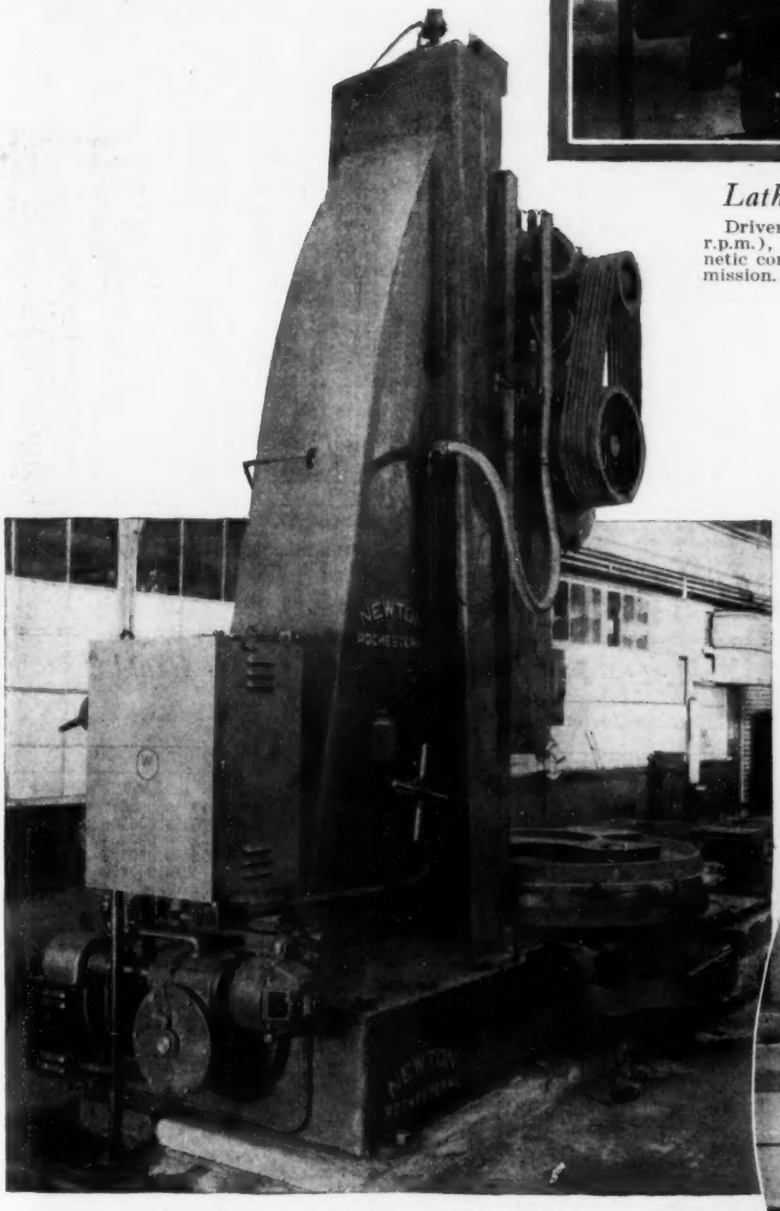
All motors are 230 volt, direct current.

achine Tool Drive and Control



Lathe—(Gisholt Simplimatic)

Driven by 10-hp., adjustable-speed (600-1,800-r.p.m.), 230-volt, direct-current motor with magnetic controller. Eight cog-belts used for transmission.



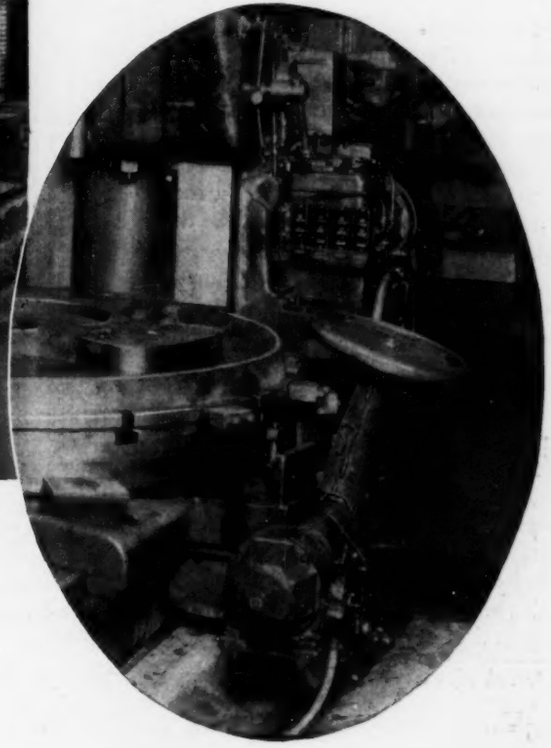
Boring and Drilling Machine (Type S Newton)

Main Drive — 15-hp., adjustable-speed (400-1,600-r.p.m.) motor with magnetic controller, permitting reversing and dynamic braking.

Table Index and Saddle Adjustment—Each provided with 1½-hp., constant-speed (1,160-r.p.m.) motor with magnetic controller for reversing and dynamic braking.

Oil Feed Pump—2-hp., constant-speed (850-r.p.m.) motor with magnetic controller.

All motors are 230 volt, direct current. The main drive is through seven cog-belts. Other motors are directly coupled. Push-button controls at right of pedestal when facing machine.



Computation of Impedance Drops*

Convenient method of determining equivalents based on power system voltage or kilovolt-ampere ratings

By Max Kushlan
New England Power Construction Company, Boston, Mass.

THE interrupting capacities of the main circuit breakers and the amount of protection required for a large power system can be determined only by studying its short-circuit conditions. In analyzing the effect of a ground or short circuit upon the various parts of the system we must take into account the relative magnitudes and arrangement of impedances in all circuits that may serve as a path between the sources of power and the point of trouble. The impedance of any part of a circuit such as a generator, transformer, reactor, transmission line, etc., may be expressed either in ohms or in per cent voltage drop, based on the rated voltage or normal kilovolt-ampere capacity of the corresponding part of the system.

The per cent impedance drop in any part of a polyphase circuit may be found by computing the voltage drop through the given ohmic impedance, assuming a normal rated current and dividing the drop by 1 per cent of the normal rated voltage to neutral. This relation may be expressed by the formula:

$$P = \frac{100KZ}{E^2} \qquad (1)$$

where P is per cent impedance drop,
K is rating in 1,000 kva.,
Z is impedance in ohms to neutral,
and E is line voltage in kilovolts.

In computing the network of a power system for determining its short-circuit characteristics it is often necessary to express the values of all impedances in ohms reduced to equivalent quantities based on a common arbitrary line voltage. From formula (1) we can deduce the relation:

$$Z = \frac{E^2P}{100K} \qquad (2)$$

where the letters have the same significance as in formula (1).

This expression enables us to translate from per cent impedance drops to equivalent ohms based on rated voltage; also to change from one voltage base to another by expressing actual ohms in terms of equivalent ohms in direct ratio of the squares of the basic voltages.

Typical Problems—The practical application of formulas (1) and (2) in computing impedance ratings may be illustrated by the following problems:

Problem 1—A three-phase generator having a reactance of 1.19 ohms per phase to neutral and a negligible resistance is rated at 40,000 kva., 13,800 volts. The generator is connected in series with a transformer bank having a 10 per cent reactance, rated at 80,000 kva.—13.8 kv. delta to 220 kv. Y. Find the combined equivalent per cent reactance of the circuit based on a rating of 80,000 kva.

From formula (1) we can compute the generator reactance to be $= \frac{100 \times 40 \times 1.19}{(13.8)^2} = \frac{4760}{190.4} = 25$ per cent. This is based on a rating of 40,000 kva. On a basis of 80,000 kva. the reactance drop would be in direct ratio of the power ratings; i.e., $25 \times \frac{80{,}000}{40{,}000} = 50$ per cent. The combined reactance of the gen-

Table I—Per Cent Impedance per Ohm

Based on formula $P = \frac{100K}{E^2}$; K = 1,000 Kva., E = Kv.

	Kilovolt-Amperes								
E (Kv.)	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000
0.115	7576	15,152	22,728	30,304	37,880	45,456	53,032	60,608	68,184
0.230	1890	3,780	5,670	7,560	9,450	11,340	13,230	15,120	17,010
0.460	472.5	945	1417.5	1890	2362.5	2835	3307.5	3780	4252.5
0.550	330.6	661.2	991.8	1322.4	1653.0	1983.6	2314.2	2644.8	2975.4
0.600	277.8	555.6	833.4	1111.2	1389	1666.8	1944.6	2222.4	2500.2
0.660	229.5	459.0	688.5	918.0	1147.5	1377.0	1606.5	1836.0	2065.5
1.20	69.44	138.88	208.32	277.76	347.20	416.64	486.08	555.52	624.96
1.32	57.39	114.78	172.17	229.56	286.95	344.34	401.73	459.12	516.51
2.3	18.90	37.80	56.70	75.60	94.50	113.40	132.30	151.20	170.10
6.6	2.295	4.590	6.885	9.180	11.47	13.770	16.065	18.360	20.655
11.0	0.8264	1.653	2.479	3.306	4.132	4.958	5.785	6.6112	7.4376
13.2	0.5739	1.148	1.722	2.296	2.870	3.443	4.017	4.5912	5.1651
13.8	0.5251	1.050	1.575	2.100	2.626	3.151	3.676	4.1008	4.7259
19.0	0.2770	0.5540	8.310	1.108	1.385	1.662	1.939	2.2160	2.4930
19.8	0.2551	0.5102	0.7653	1.020	1.276	1.531	1.786	2.0408	2.2959
22.0	0.2066	0.4132	0.6198	0.8264	1.033	1.240	1.446	1.6528	1.8594
33.0	0.0918	0.1836	0.2754	0.3672	0.4590	0.5508	0.6426	0.7344	0.8262
44.0	0.0516	0.1032	0.1548	0.2064	0.2580	0.3096	0.3612	0.4128	0.4644
66.0	0.0229	0.0458	0.0687	0.0916	0.1145	0.1374	0.1603	0.1832	0.2061
110.0	0.00826	0.01652	0.02478	0.03304	0.04130	0.04956	0.05782	0.06608	0.07434
145.0	0.00476	0.00952	0.01428	0.01904	0.02380	0.02856	0.03332	0.03808	0.04284
154.0	0.00422	0.00844	0.01266	0.01688	0.02110	0.02532	0.02954	0.03376	0.03798
167.0	0.00358	0.00716	0.01074	0.01432	0.01790	0.02148	0.02506	0.02864	0.03222
220.0	0.00207	0.00414	0.00621	0.00828	0.01035	0.01242	0.01449	0.01656	0.01863

Directions: To change to any other kilovolt-ampere basis multiply the nearest value from table by the ratio of the kilovolt-amperes.
Example: Find per cent reactance for 1.19 ohms in a generator rated at 40,000 kva., 13,800 volts. The nearest value for 13.8 kv. and 4,000 kva. is 2.100 per cent per ohm.

Then $P = 2.100 \times 1.19 \times \frac{40{,}000}{4{,}000} = 25.0$ per cent.

Table II—Impedance in Ohms at 1 per Cent

Based on formula $Z = \frac{E^2}{100K}$; K = 1,000 Kva., E = Kv.

	Kilovolt-Amperes								
(Kv.)	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000
0.115	0.000132	0.000066	0.000044	0.000033	0.000026	0.000022	0.000019	0.000017	0.000015
0.230	0.000529	0.000264	0.000176	0.000132	0.000106	0.000088	0.000076	0.000066	0.000059
0.460	0.002116	0.001058	0.000705	0.000529	0.000423	0.000353	0.000302	0.000264	0.000235
0.550	0.003025	0.001512	0.001008	0.000756	0.000605	0.000504	0.000432	0.000378	0.000336
0.600	0.003600	0.001800	0.001200	0.000900	0.000720	0.000600	0.000514	0.000450	0.000400
0.660	0.004356	0.002178	0.001452	0.001089	0.000871	0.000726	0.000622	0.000544	0.000484
1.200	0.014440	0.007200	0.004800	0.003600	0.002880	0.002400	0.002057	0.001800	0.001600
1.320	0.017424	0.008712	0.005808	0.004356	0.003485	0.002904	0.002489	0.002178	0.001936
2.300	0.052900	0.026450	0.017633	0.013225	0.010580	0.008817	0.007559	0.006612	0.005878
6.600	0.435600	0.217800	0.145200	0.108900	0.087120	0.072600	0.062229	0.054450	0.048400
11.000	1.21000	0.605000	0.403333	0.30250	0.24200	0.20167	0.17286	0.15125	0.13444
13.200	1.74200	0.87100	0.58067	0.43550	0.34840	0.29033	0.24886	0.21775	0.19355
13.800	1.90400	0.95200	0.63466	0.47600	0.38080	0.31733	0.27200	0.23800	0.21155
19.000	3.61000	1.8050	1.2033	0.90250	0.72200	0.60166	0.51571	0.45125	0.40111
19.800	3.92000	1.9600	1.3066	0.98000	0.78400	0.65333	0.56000	0.49000	0.43555
22.000	4.84000	2.4200	1.6133	1.2100	0.96800	0.80667	0.69143	0.60500	0.53778
33.000	10.8900	5.4450	3.6300	2.7225	2.1780	1.8150	1.5557	1.36125	1.2100
44.000	19.3600	9.6800	6.4533	4.8400	3.8720	3.2267	2.7657	2.4200	2.1511
66.000	43.5600	21.780	14.520	10.890	8.7120	7.2600	6.2229	5.4450	4.8400
110.000	121.000	60.500	40.333	30.250	24.200	20.167	17.286	15.125	13.444
145.000	210.300	105.15	70.100	52.575	42.060	35.050	30.043	26.288	23.367
154.000	237.200	118.60	79.067	59.300	47.440	39.533	33.886	29.650	26.355
167.000	278.89	139.445	92.963	69.722	55.778	46.481	39.841	34.861	30.988
220.000	484.00	242.00	161.33	121.00	96.800	80.667	69.143	60.500	53.778

Directions: To change to any other kilovolt-ampere basis divide the nearest value from table by ratio of the kilovolt-amperes.
Example: Find impedance in ohms producing 25 per cent impedance in a generator rated at 40,000 kva., 13,800 volts. The nearest value for 13.8 kv. and 4,000 kva. is 0.476 ohm at 1 per cent impedance.

$Z = 0.476 \times 25 \times \frac{4{,}000}{40{,}000} = 1.19$ ohms.

To change impedance in ohms to another voltage basis multiply by the square of the voltage ratio. Thus, at 27.6 kv., $Z = 1.19 \times \left(\frac{27.6}{13.8}\right)^2 = 4.76$ ohms.

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erator and transformer bank in series = 50 + 10 = 60 per cent.

Problem 2—The same circuit given in problem 1 to be expressed in terms of ohmic reactance based on 220,000 volts. The reactance of the transformer bank based on 220 kv. may be computed by formula (2) to be:

$$\frac{(220)^2 \times 10}{100 \times 80} = \frac{484{,}000}{8{,}000} = 60.5 \text{ ohms.}$$

The reactance of the generator based on 220 kv. is in direct ratio with the squares of the basic voltages, which equals:

$$1.19 \times \left(\frac{220}{13.8}\right)^2 = 1.19 \times 256 = 304.64 \text{ ohms.}$$

The total reactance in ohms based on 220 kv. for the generator and the transformer bank connected in series is equal to:

$$60.50 + 304.64 = 365.14 \text{ ohms.}$$

Impedance Calculating Tables—The calculation of impedances for use in connection with system diagrams may be simplified by the aid of special tables, such as I and II, which are designed to reduce such computations to a few simple multiplications.

Table I gives the values of impedances in per cent drop per ohm for certain voltages in common use, for kilovolt-ampere ratings varying from 1,000 to 9,000. It is assumed that the impedance of the circuit to be solved is given in ohms to neutral, also that the circuit rating is given in kilovolts and kilovolt-amperes. From Table I we find a factor corresponding to the given kilovolts and the nearest value of kilovolt-amperes. This factor is multiplied by the product of the ohms times the ratio of the rated kilovolt-amperes to the nearest value used in the table. In case the rated kilovolts of the circuit cannot be found in the table, use the factor for the nearest voltage and multiply the product by the square of the ratio between the nearest tabulated and the specified voltage ratings. To illustrate, we will assume that it is necessary to show on a system wiring diagram in terms of per cent drop the impedance of 0.1 ohm in a generator rated at 50,000 kilovolt-amperes, having a line voltage of 10,000. From Table I we find the nearest factor for 11 kilovolts and for 5,000 kilovolt-amperes to be 4.130.

$$\text{At 11,000 volts } P = 4.130 \times 0.01 \times \frac{50{,}000}{5{,}000} = 4.13 \text{ per cent.}$$

$$\text{At 10,000 volts } P = 4.13 \times \left(\frac{11}{10}\right)^2 = 4.13 \times 1.21 = 5.0 \text{ per cent.}$$

Table II is the reverse of Table I, since it gives the values of impedances in ohms for 1 per cent drop for the same range in rated voltages and kilovolt-amperes as in Table I. We will assume that the impedance of the circuit to be solved is given in per cent drop and it is necessary to convert it into equivalent ohms. From Table II we find the nearest factor corresponding to the given rating. This factor is multiplied by the given per cent drop and divided by the ratio of the given kilovolt-amperes to the value used in the table. To change this impedance to equivalent ohms based on a different voltage, multiply the first result by the square of the ratio of the new voltage to the voltage which was the basis for the tabulated factor.

The practical application of Table II can be demonstrated by solving the following problem:

A system diagram indicates a circuit having a reactance of 5 per cent, rated at 50,000 kilovolt-amperes. For solving the network shown on this diagram it is necessary to reduce this value to equivalent ohms based on 10,000 volts.

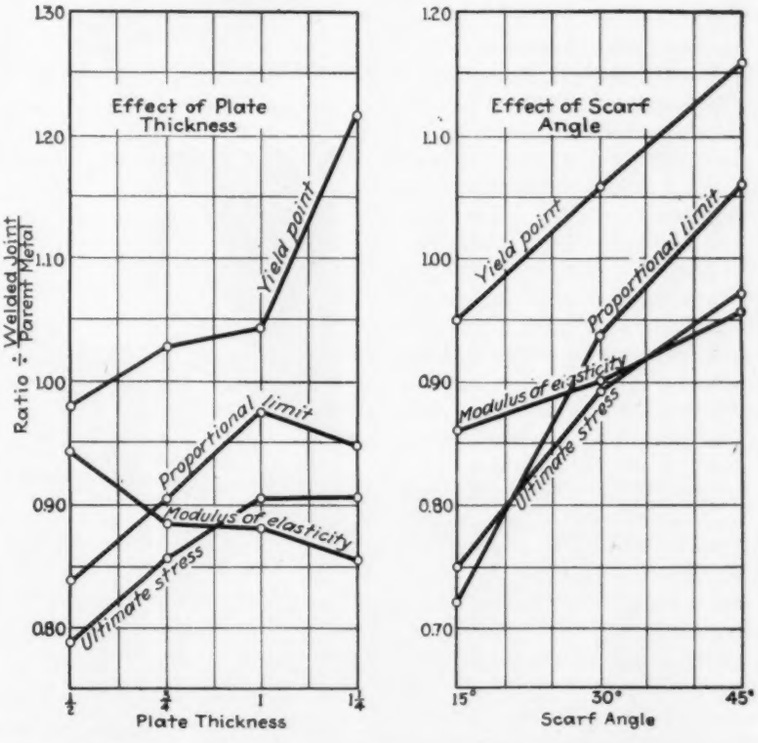
From Table II we find the nearest factor for 11 kv. and 5,000 kva. to be 0.242 ohms.

$$\text{At 11 kv. } Z = 0.242 \times 5 \times \frac{5{,}000}{50{,}000} = 0.242 \times 0.5 - 0.121 \text{ ohms.}$$

$$\text{At 10 kv. } Z = 0.121 \times \left(\frac{10}{11}\right)^2 = 0.100 \text{ ohms.}$$

Table I is particularly useful in reducing impedance values to equivalent per cent drops based on some common kilovolt-ampere rating. Table II is used for the more accurate mathematical solutions of networks.

Strength of Butt Welds Made with Metallic Arc



RESULTS of tests on metallic arc-welded butt joints were presented by G. Tobo, Jr., research engineer of the Westinghouse Electric & Manufacturing Company, recently before the American Welding Society. Two sets of observations are illustrated above.

As a result of this investigation the following conclusions were reached:

1. 45 deg. is the best angle of bevel for a joint, the strength decreasing with the angle.
2. A single V joint is stronger than a double V.
3. Strength of welded joints increases up to at least a 1-in. thickness of plate.

A 45-deg. single V joint is thus determined as being the best joint as far as strength is concerned, but economic factors dictate the use of other types for cases where strength is not the main factor.

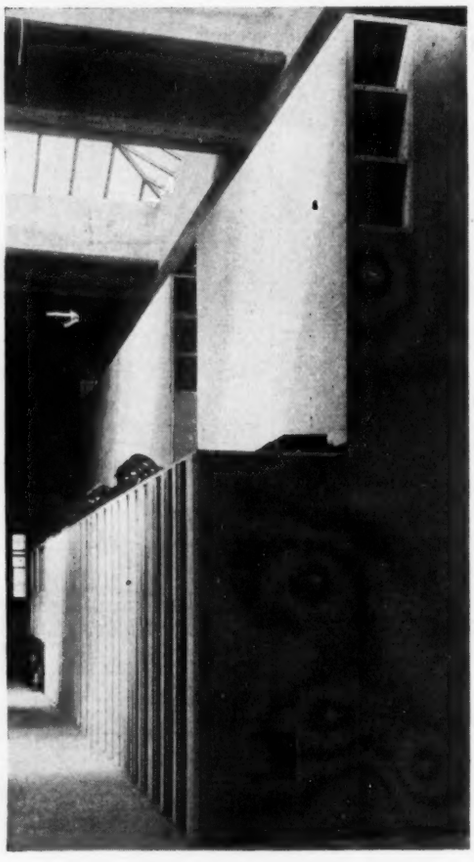
Fabricated Materials for Switch and Bus Cells

Experience with use of gypsum and asbestos in substations which have been recently constructed in Port Chester, Mamaroneck and Ossining

By R. E. DENNIS
Chief Electrical Engineer
Westchester Lighting Company, Mount Vernon, N. Y.

IN THE construction of electric substations on this system it has been the practice for some years to house high-voltage equipment and equipment containing a quantity of insulating oil in compartments built of concrete or brick, and more lately of steel, where conditions did not warrant their installation out of doors. Building construction costs in the territory served by this company are relatively high. Moreover, the growth of the electric load has been so rapid that it was advisable to provide structures adequate to meet the present needs and with room for considerable future expansion. Naturally, the operating costs have been comparatively heavy in the first few years of service. To overcome this attention was directed to the development of designs which would permit of convenient and economical expansion as the growth of load demanded.

Three new substations were planned and it was thought that some changes in the previous practice would show considerable saving. It was decided to construct the building to ultimate dimensions, installing the heating and plumbing facilities and the cable ducts complete. The electrical layout was easily arranged to provide for unit installation and apparatus for present load only had to be purchased and installed. A similar plan for compartment construction was devised. If the compartments and equipment were limited to present requirements and installed together by the same crew impressive reductions in cost appeared possible, unless a premium had to be paid for materials suited to the plan. For the 4-kv. portion of two of the proposed substations steel cubicles were considered adequate and economical and were specified. For the 4-kv. section of the other substation and the 14-kv. sections of all three the use of materials having greater insulating value, together with the necessary strength and fire-resisting characteristics, was favored.



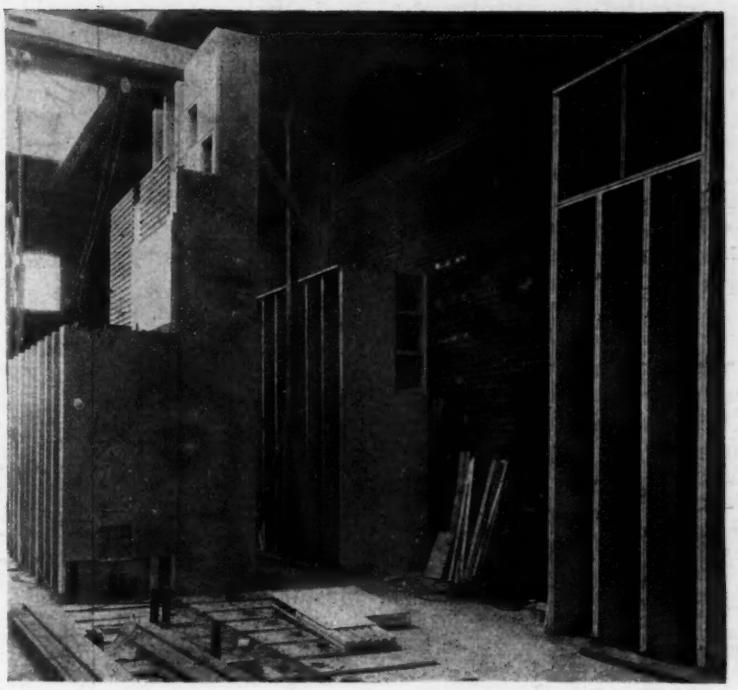
14-Kv. Breaker and Bus Compartments of Asbestos Board

Three years ago the market was singularly bare of prospects. Materials could be had, but the proper fabrication presented a problem A start was made by the discovery of a company which could produce a product somewhat similar to gypsum plaster board and ship it in slabs of standard sizes. A field crew could cut and fit it on the job with ordinary woodworking tools. Several installations, including a generating station, using this material for compartments housing General Electric type H-203 oil circuit breakers were inspected. Dielectric tests, impact tests and other tests were made, all of which indicated that it would be satisfactory, and it was considered available for the purpose. About this time, also, we were informed that stone and asbestos material could be supplied for such compartment work as soon as additional facilities for fabrication could be provided. The building plans were drawn so that all three could be used, provided that cost and other factors made it seem desirable.

Considerable experience with the asbestos material and stone product for other purposes was helpful and made their advantages familiar. We had had no experience, however, with the gypsum product. From known and assumed factors a preliminary rating was given to each, independent of cost, which was tentative only and merely intended as a guide in the selection.

It was considered that: Stone was the heaviest, and might therefore be difficult to handle in large sections; that it was strong in compression and had good fire-resisting qualities; that it might be liable to fracture if subjected to sharp mechanical shock; that its dielectric

strength was very good. Asbestos was lighter than stone and might be easier to handle and erect; that its fire-resisting quality was well known; it was not liable to fracture; its dielectric strength, while lower, was satisfactory; previous experience with this substance was especially satisfactory. Gypsum was the lightest; could be easily worked; had good fire-resisting qualities; the impact tests showed that it was not readily fractured; it had satisfactory dielectric strength, being much better than concrete.



14-Kv. Asbestos-Board Compartments with Corrugated Reinforcement of Larger Sections

After bids had been received, it was decided to construct the compartments in the Ossining substation, which was the first to be built, using all three materials, divided as follows: 14-kv. oil circuit breaker and regulator compartments of stone, 4-kv. oil circuit breaker compartments of asbestos board, 14-kv. disconnecting switch and pothead compartments of gypsum board.

Unfortunately, it was impossible to wait for experience at Ossining before deciding what material was most suitable and economical for use in the other substations under construction. Therefore, it was decided to build the compartments in the Port Chester substation throughout with asbestos board, except the 4-kv. oil circuit breaker compartments, which were the familiar steel cubicle type. The installation at Port Chester can be considered typical of asbestos board construction in a substation of similar size. At Mamaroneck substation the 14-kv. apparatus was all to be installed out of doors and the 4-kv. oil circuit breakers were to be of the so-called iron-clad type, leaving only regulators, reactors, disconnecting switches and bus structures having static load to be housed in compartments. It was decided to employ the gypsum board throughout for this purpose.

The construction of the compartments in all three substations has now been finished, with the exception of the installation of the doors. This work will not be done until the electrical apparatus has been installed and connected. Although it will be some time before experience in operation can be gained, there is available now some information regarding installation experience and costs which may be interesting to other companies proposing to do similar work. The accompanying tables give data on all three jobs and for comparison similar data are given on the last substation, using hard-pressed brick for compartments, included in the building contract. The compartments which have been constructed of concrete have cost about the same as the brick compartments, although probably this is not usually the case.

The manufacturer in each case supplied an erecting superintendent, who aided materially in solving the field

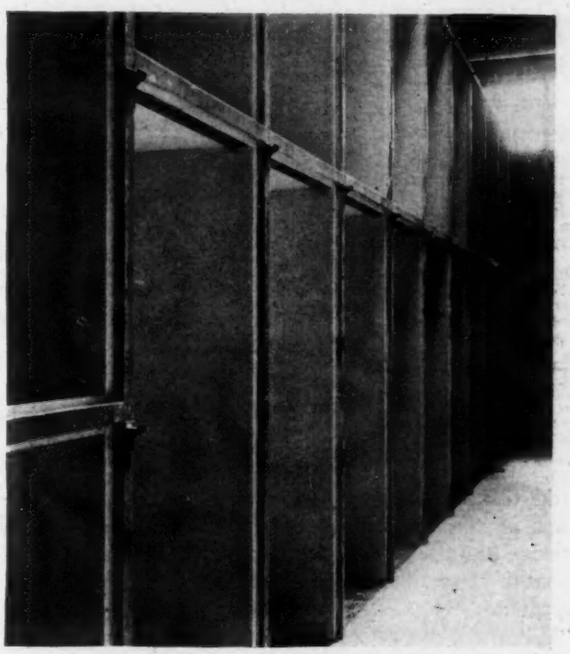
Cost Data on Various Types of Cell Structures

Substation	Type of Material	Man-Hours Erecting	Time Taken to Erect, Days	Total Cost	Cu. Ft. in Structure	Cost per Cu. Ft
Mamaroneck	Gypsum	3,280	41	$12,332.52	9,224	$1.337
Port Chester	Asbestos	7,200	90	27,672.85	11,608	2.3839
Ossining.....	Stone	5,248	82	24,054.76	10,116	2.3782
	Gypsum	720	15	3,655.42	1,826	2.001
	Asbestos	1,344	28	9,286.99	3,153	2.9454
Eastchester..	Brick	....	120	73,139.72	20,456	3.5754

Note.—Doors and trim are included in cost of material and total cost. Cost of installing trim included in all except Eastchester. Cost of installing doors not included in any of the above.

Test Data on Various Types of Cell Structures

Material	Resistance, Megohms	Alternating-Current Breakdown Kilovolts	Alternating-Current Breakdown Milliamperes	Direct-Current Breakdown Kilovolts	Direct-Current Breakdown Milliamperes
Gypsum, 1 in. thick	32	29	7	34.7	0.36
Stone, 1 $\frac{1}{16}$ in. thick	5000+	30+	7+	60+	0.306
	(Samples withstood available voltage.)				
Asbestos, 1 $\frac{1}{16}$ in. thick	1.0	3	60	6.7	9.7
Concrete, 1 in. thick	108.3	10	4	15.7	0.5



Gypsum Board, Cut with Woodworking Tools, for Reactor Compartments

problems which arose and permitted the employment of less skilled labor for most of the work. In spite of this aid, however, the time required for erection was in excess of the estimate, except in Mamaroneck. Greater familiarity with handling materials of this kind for such work will no doubt bring about a reduction in installation cost due to a saving in the time required. Also, the manufacturers have gained experience which may enable them to devise a means of erection and support which will not only use less material but will simplify the construction work involved and make it still easier to provide for future requirements.

The experience with these substations leads to the belief that it is feasible and economical to build substation compartments or bus structures by the employment of fabricated materials, which with proper supervision can be erected by ordinary field forces, thus permitting additional units to be added with the electrical equipment as the load increases. It is possible that the saving in construction costs secured by such designs may suggest a change in the methods generally employed heretofore.

Leaving Meters Connected Despite Difficulties

TWO fundamental sources of difficulty have been observed by the various districts of one widespread utility system in the East in leaving meters connected when tenants move out. These difficulties are:

The failure of consumers to notify the company when they move into vacant premises.

Minor difficulties in connection with writing off small amounts of energy which are unaccounted for in such cases.

Generally speaking, the districts where population is stable are divided in their opinion as to whether the practice is satisfactory or not. The resort districts, where the tenancies are of short duration and held by people who normally live clear outside the territory, generally consider the practice unsatisfactory.

One district reports specifically as follows:

"Our experience with the plan of leaving electric meters connected for residential customers for the year ended April 30, 1929, shapes up as follows:

Customers moved		6,800
Notification by phone from incoming customers, per cent		70
Notification in person at office, per cent		10
No notification received, per cent		20
Value of service used by 86 unknown customers written off to uncollectible bills		$125.00
Men and auto checking meters in use (average two hours per day)	Cost per year	
	Labor	400.00
	Automobile	300.00
Cost of cards (including postage) left on customers' premises		100.54
Total cost		$925.54
Average cost per customer 13.6 cents		

"Strange to say, we have received less than 20 postcards from the customers during the year.

"Unless there is a large discrepancy between the 'Read Off' and 'Read On' readings the incoming customer is reconnected at the 'Read Off' reading. Experience has taught us that frequently the customer does not notify us until he has occupied the premises for several days.

"When the discrepancy in readings is great, we usually find that during the interim of occupancy the owner uses the service in renovating the apartment. This, of course, is collected from the owner."

Considering the good will value of the activity, the vice-president and commercial manager of the company declares that the practice is a sound one, worth many times the expense of its administration.

Letters from Our Readers

Faraday Centenary

To the Editor of the ELECTRICAL WORLD:

I see that in your issue of July 13 you refer to a forthcoming anniversary of Michael Faraday's discovery of the relationship between electricity and magnetism. You give a short account of Dr. Elihu Thomson's reference to the matter at the recent Swampscott convention of the American Institute of Electrical Engineers.

I would thank you, in the first place, for your very friendly reference to a centenary for which the Royal Institution of Great Britain is already making arrangements. I inclose a memorandum giving certain details which will, I hope, interest you and your readers. A similar memorandum is being published as widely as possible in order that all who are interested in Faraday's work may become acquainted with the nature of the proposed celebrations.

The two days devoted to the commemoration of the Faraday centenary are September 21 and 22, 1931. It happens that they will be followed by the centenary meetings of the British Association for Advancement of Science, which will be held in London on September 23 to September 30.

W. H. BRAGG.

Davy-Faraday Research,
The Royal Institution, London.

Faraday Electromagnetic Centenary

THE arrangements initiated by the Royal Institution for the celebration of the centenary of Faraday's discovery of electromagnetic induction have already been announced. At the representative meeting held at the house of the Institution on February 5, 1929, the formation of two committees was agreed to, and these committees are now at work. The first, consisting of representatives of the Royal Society, the British Association and other scientific societies, as well as the Royal Institution, is concerned with the purely scientific aspects of Faraday's work in relation to the proposed celebrations; the second committee, which has been called together by the Institution of Electrical Engineers, consists of representatives of the principal organizations of those industries which have risen in the past hundred years upon the scientific foundation of Faraday's discoveries and is dealing with the industrial aspects of the celebrations.

The two committees are working in close cooperation; the preliminary discussions which have taken place indicate that the significance of the centenary is very widely appreciated and that the celebrations are likely to arouse world-wide interest and support. The dates have now been fixed, and the proceedings will commence in London on Monday, September 21, 1931. Further, an intimation has been received from the British Association that its centenary meeting will be held in London during the week commencing September 23, 1931. These two centenaries, with important electrical conferences and other events which are to take place about the same time, will thus conjoin to make the year 1931 a memorable one in this and every country where the genius of Faraday has borne fruit.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Nine-Foot Free Discharge Needle Valve.—A regulating free-discharge needle valve which measures 9 ft. in diameter at the outlet is being used on the Sugarloaf Rubicon hydro-electric development in Victoria, Australia, to by-pass water from the impounding reservoir and thus maintain stream flow when the turbines are shut down. It operates under a 185-ft. head and is actuated by hand power, transmitted by spur-and-worm gear through a vertical shaft to a pinion engaging with a steel rack attached to the plunger. This shaft passes through a passage cored in one of the ribs and is therefore not exposed to the action of the flowing water. The plunger will remain stationary in any position so hunting or creeping is impossible. The power required to operate the valve is reduced to a minimum by hydraulically balancing the plunger. Particular attention has been given to the thorough lubrication of all parts of the operating gear grease-gun pipes being led to the pinion bearings on the vertical shaft, to the rack teeth and to the rack guide. The worm gear is immersed in an oil bath, grease cups and oil lubricators being provided on all the remaining bearings. A bronze liner is provided inside the working cylinder to prevent corrosion. Leakage past the is reduced to a negligible quantity by a Dexine packing ring, and scour valves are provided to remove any dirt or scale that may accumulate. The whole operating gear can be removed for inspection and replacement whenever desired, without emptying the tunnel or penstock upstream, of the valve, or in any way interfering with the normal running of the power station.—*Engineering* (*England*), July 26, 1929.

Transmission, Substations and Distribution

Investigation of Losses from Lightning.—Data have been collected by the Western Actuarial Bureau from about 240 electric light and power companies in 30 states on the extent of damage from lightning. The data covers principally the years 1925 and 1926. The total value of property exposed to damage was reported to be about $820,000,000 and the total losses attributed to lightning over the two-year period amounted to about 0.04 per cent per year. Nearly 4,500 cases of damage were reported, although lightning arresters were used in 80 per cent of the cases. The nature and extent of the damage is summarized below:

Apparatus Damaged	Total Number	Having Arrester Protection
Transformer including 296 bushings	1,774	1,610
Metering equipment	1,280	1,250
Lightning arresters	137	....
Rotating machines	117	110
Oil switches, including 30 bushings	146	133
Air-break switches	71	61
Switchboards	13	13
Bus structures or insulators	35	34
Potheads	5	5
Line insulators	408	371
Line conductors	241	215
Pole or cross arm	215	155

An attempt was also made to establish a measure of the severity of lightning in each state by multiplying the number of miles of primary line by the number of lightning seasons involved and dividing by the cases of damage experienced. On this basis the states from which sufficient data were obtained ranked in the following order: Arkansas, Kentucky, Illinois, Iowa, Kansas, Colorado, Indiana, Ohio, Arizona, California and Idaho.—*Technical News Bulletin, No. 147, Bureau of Standards,* July, 1929.

Motors and Control

Electric Drive of Machine Tools.—C. H. S. TUPHOLME.—The author discusses methods of securing safe acceleration, simplicity and flexibility of control, adaptability to peculiarities of operation (by inching, dynamic braking, speed control and overload protection), reliability and safety. In considering these phases of the subject he dealt with magnetic lock-out accelerating relays, shunt-holding coils, vibrating and trembling relays, low-voltage protection for reinsertion of starting resistance, mechanical interlocking of controls and condensers across field contactors.—*Electricity* (*England*), July 26, 1929.

Electrophysics, Electrochemistry and Batteries

Comparison of the Formulas for the Calculation of the Inductance of Coils and Spirals.—F. W. GROVER.—Two methods have been used for the calculation of the inductance of coils of wire having a relatively large cross-section. Of these, the summation method gives the inductance of the coil as the sum of the self-inductances of the turns and the mutual inductances of all the pairs of turns. The Rosa method calculates the inductance of the equivalent current sheet as a first approximation to the inductance of the coil and obtains the correction which must be applied by calculating (a) the differences between the self-inductance of the turns of wire and of the current sheet and (b) the differences of the mutual inductances of pairs of turns of wire and of the corresponding turns of the current sheet. It is here shown that, contrary to previous opinions, the two methods give identical results when terms of the same degree are retained in the series expression.—*Bureau of Standards, Research Paper No. 90.*

Generation, Control, Switching and Protection

Transformer Tap Changing on Load.—Features of construction of a 6,000-kva., 11,500-volt transformer so taps can be changed under load are described. A 24 per cent winding on each phase is divided into six tapping sections, and connections are taken to one side of seven tap switches, while the other sides of alternate switches are connected together, and the two common connections of each phase are taken to the outside terminals of a continuously rated reactor, which is tapped at the center and is utilized during the transfer from tap to tap. It also provides a means of doubling the number of effective tapping positions in the well-known manner. The center tappings of the reactor windings provide the outgoing line terminals. The auto-transformer and reactor are placed in a single tubular tank and the tap-changing switchgear is mounted in a separate oil-filled compartment. The contactor type switches are operated through push rods by motordriven cams in the lower part of the switch tank. The cams have separate "opening" and closing faces and the mechanism is arranged so that the break is always made quickly, while the make is positive. In the event of the contacts sticking, a following portion of the cam insures a positive break in the correct sequence before the next tap-changing operation is commenced. Reduction gearing driven by the motor drives a camshaft which makes one revolution for every tapping change and operates two "notching" switches, which insure that once the motor has been energized it will continue to run during one complete tapping change and then stop. Once started up, it must be re-energized to make a further change.—*Engineer* (*England*), July 26, 1929.

Safe Loading of Oil-Immersed Transformers.—E. T. MORRIS.—An attempt to describe simply and clearly the basis of the temperature rating of oil-immersed transformers and the relations between the temperatures measured in service, the maximum safe output and the national standard ratings. An instrument is described for indicating the safe output in service under any conditions of short-time or continuous loading.—*A.I.E.E. Journal,* August, 1929.

News of the Industry

Governors to Confer Again on Boulder Dam

Utah's Executive Asks the Other Six Concerned to Discuss Permits and Price of Energy at Salt Lake City—Mead Answers Questions

POWER permits on the Colorado River and the price at which power generated at Boulder Dam is to be sold are expected to be considered in Salt Lake City on August 28 at a conference of governors of the seven interested states called by Governor G. H. Dern of Utah to follow an eleven-state Western governors' conference in that city.

A meeting of representatives of Colorado, Nevada, Utah, Wyoming, New Mexico and Arizona was held in Denver at the Reclamation Bureau office on August 12 to 14. L. N. McLellan, an engineer attached to the bureau at Denver, and E. F. Scattergood, electrical engineer of the Los Angeles Department of Power and Water, were named members of a committee on power rates. Dr. Elwood Mead, Commissioner of Reclamation, informed the meeting that, with 550 000 hp. as maximum output from Boulder Dam, already applications have been made for more than 1,000,000 hp., chiefly from power companies and municipalities in California, Arizona, Nevada and Utah. Answering questions from governors, Dr. Mead said:

"This conference on details of the power problems has been very productive of necessary data, and we are all agreed on the fundamental fact that the future needs of the area tributary to the dam must be taken into consideration. All contracts for the sale of power made in the initial plan will provide that the future requirements must be protected so that late comers into the field can be served, and the industrial development of the territory shall not be hampered so far as it is in our power to prevent. There will be no contracts formulated at this time for the purchase and sale of power, and the present conference will merely compile the data for presentation to Dr. Wilbur, Secretary of the Interior, the only official having authority to sign contracts."

Los Angeles Asks for More

Two hundred thousand peak horsepower will be added to the output of Boulder Dam should the government follow the recommendations of a resolution adopted recently by the Los Angeles Department of Power and Water.

The resolution asks that the height of the dam be raised from 550 ft. to 575 ft., giving as reasons: (1 Better flood control; (2) more complete regulation of the Colorado River; (3) large increase in power at a lower rate.

This action by the board was the result of extensive surveys made by F. E. Weymouth, chief engineer of the metropolitan water district. No change in the already passed federal legislation will be necessary, it is asserted.

Senate Finance Committee Cuts Electrical Tariff

A far-reaching reduction in the tariff clauses affecting electrical machinery and equipment is made in the bill reported on Tuesday, August 20, by the Senate finance committee. The rate specified in the main electrical paragraph, 353 (including generating, rectifying and control equipment, locomotives and appliances) was reduced from the House rate of 40 per cent to the old machine basket-clause rate of 30 per cent, although the Senate basket-clause rate has been raised to 35 per cent ad valorem. This puts the electrical equipment field in the lowest machinery bracket on the proposed tariff.

The rate on electric light bulbs with filaments has been changed from 30 per cent ad valorem to 25 per cent if the filaments are of metal and to 1 cent each plus 30 per cent if they are of carbon or other non-metallic material. Illuminating articles stood at 65 per cent in the House bill. The Senate revision puts prisms at 30 per cent, chimneys at 55 per cent, globes and shades at 85 per cent, and all others and parts thereof at 60 per cent. Carbon electrodes less than one-half inch in diameter or of equivalent cross-sectional area have been increased from 45 to 60 per cent ad valorem.

Scenery Questions Still to the Fore

General Jadwin Alone on Park and Planning Commission in Favoring Potomac Development—Attorney-General of Kentucky Falls Foul of Cumberland Falls Project

By Paul Wooton
Washington Correspondent for the Electrical World

THAT the parks "should fit into the scheme of the nation and not the nation into the scheme of the parks" is one of the points made by General Jadwin in submitting minority views on the report of the National Capital Park and Planning Commission. General Jadwin during his term as chief of engineers served as chairman of this commission. The other members—eight in number—took the position that it would be "inadvisable to decide now upon the destruction for all time of scenic and recreational and inspirational assets of such large prospective importance as those included in the valley of the Potomac at the doors of the national capital."

This report will be submitted to Congress along with that of General Jadwin in his capacity as chief of engineers which, as reported last week, favors the development of power on the Potomac at Great Falls. General Jadwin concurs in the report of the district engineer, Major Brehon B. Somervell, who estimates the cost of power produced at Great Falls under the plan submitted by the Potomac River Corporation at approximately $1,000,000 per annum less than the equivalent steam power.

"The decision lies," General Jadwin says, "between a park prodigal of the latent resources of the Potomac and an equally good park conserving these resources. Combined park and power development is feasible, and the waste of more than $48,000,000 of potential values for debatable minor scenic consideration is neither necessary, desirable nor sound."

The majority of the Park and Planning Commission report that the combined park and power projects would result in a totally different kind of park from the natural valley. The price of creating this different and less valuable kind of park would not merely be a matter of dollars. Years would be necessary for the scars to heal, and there would be destruction for all time of the essential characteristics which make the present natural river valley unique and distinctive.

A brief filled with emphatic expressions has been submitted in the Cumberland Falls case by J. W. Cammack, the Attorney-General of Kentucky. He contends that the contract between the Cumberland River Power Company and the Kentucky Park Commission is illegal. He takes the position that the park commission has no authority to take title to the lands which the power company would make available for park purposes. In addition to his criticism

of the commission for having exceeded its authority he holds that the contract is indefensible, unfortunate and unwise and barters away the rights of Kentucky for a "mess of pottage."

It is apparent from the wording of the brief that it is intended to serve the double purpose of opposing the Cumberland Falls development and of embarrassing the Governor of the state, the head of the park commission, who is of a different political faith. Mr. Cammack contends that the project "entirely and completely destroys the falls as a place of scenic beauty. Its value as an attraction would be completely lost. Kentucky and her people would be deprived of the finest piece of natural scenery in the state and the greatest in the United States except Niagara Falls. What a crime!"

Mr. Cammack goes into detail in an effort to establish that the federal government engineers are wrong in their conclusions as to the maximum utilization of the resources of the river. He says in addition that coal is so cheap in eastern Kentucky that electricity can be produced at less cost by steam than by hydro power. He also takes the position that the development of this hydro power would diminish consumption of coal and decrease the demand for labor in Kentucky mines.

New England Gives Welcome to Municipal Electricians

Discussions of the wiring code, fire protection, street-lighting practice and progress in traffic control, fire-alarm and police-telegraph systems featured the thirty-fourth annual convention of the International Association of Municipal Electricians, held at Boston from Tuesday to Friday of this week. The program included business sessions at the Hotel Statler, an all-day session on street lighting and traffic signaling at the Lynn works of the General Electric Company, and attractive entertainment features at nearby shore resorts. Noteworthy advances in equipment for electric service in municipal channels were described in several papers and there was an excellent exhibit of manufactured products of special interest to the membership at the Hotel Statler. Many committee reports were presented.

At the code session on Tuesday H. B. Kirkland of the Society for Electrical Development advocated uniformity in electrical ordinances. Recent progress in code development was outlined by Dr. M. G. Lloyd of the Bureau of Standards and Victor H. Tousley, field engineer National Fire Protection Association. Carl Krieger described the latest work of the Underwriters' Laboratories, Inc., and C. W. Abbott of the General Cable Corporation, New York, spoke on the "New Flexible Cord Standard."

At the session in Lynn Wednesday C. A. B. Halvorson of the General Electric Company gave a talk on "Airport Lighting," and L. A. S. Wood of the Westinghouse company spoke on "Financing Modern Street Lighting." A. E. Noble was heard on "Neon Lighting." A. L. Pierce, Wallingford, Conn., presented an exhaustive report on street-lighting circuits and municipal-plant affairs, which included a section by F. G. Frost on improvements in street lighting at New Orleans.

Northern Illinois Company Interconnects Zones

Another important step in the development of the system of the Public Service Company of Northern Illinois has just been taken in the completion of a 132-kv. transmission line between Electric Junction and Joliet. The new line, which is 24 miles long and has 151 steel towers, completes an "outer belt" of the system extending from Waukegan and the Wisconsin State Line west to Crystal Lake, south to Electric Junction, southeast to Joliet, east to Chicago Heights, and north and east to the Indiana State Line and to Chicago, where it interconnects with the Commonwealth Edison Company system.

The line provides direct connection between the Northern Illinois company's north zone, having as its principal source of power the Waukegan generating station, and its south zone, which receives its power from the Joliet, Powerton, Blue Island and State Line generating stations.

The 132-kv. line from Waukegan to Joliet is tapped at two places, Crystal Lake and Electric Junction. The Crystal Lake tap consists of a switching center which will ultimately serve as a source of power for the consumption in the near vicinity, as well as provide a means for interconnection to the transmission system of the Illinois Northern Utilities Company and other systems. The tap at Electric Junction, which is a few miles northeast of Aurora, is now one of the important switching centers in the company's territory. The energy is there transformed for distribution at lower voltages to the suburban districts west of Chicago and also to the Western United Gas & Electric Company at Aurora and elsewhere.

Rates in Near-Philadelphia Region Cut $700,000

Electric bills of householders, farmers and industries in Montgomery and Chester Counties and part of Delaware County, Pa., all in the Philadelphia section, are reduced about $700,000 a year by a new rate schedule announced on August 13 by the Philadelphia Suburban-Counties Gas & Electric Company as effective on September 12. The company is a subsidiary of the Philadelphia Electric Company.

The average saving to 80 per cent of the consumers will be 25 cents a month, the company estimates. It also reckons that reductions and savings since April, 1928, in electric and gas service will save the consumers in that area $2,500,000 in 1930.

Householders will pay 9 cents a kilowatt-hour for the first 25 kw.-hr. a month, instead of 10 cents. The rate for the next 36 kw.-hr. remains the same—6 cents. For additional energy used, the rate will be 3 cents, instead of 4. The new residential rate also drops the use of the capacity factor.

The new commercial rate shows a reduction from 10 cents to 9 cents for the first 48 hours' use of meter capacity and is reduced from 4 cents to 3 cents for all energy in excess of 96 hours' use, the intermediary rate remaining at 6 cents.

The agricultural rate is cut from 10 cents to 9 cents for the first 50 kw.-hr. a month and from 4 to 3 cents in the third step.

International Water Commission Meets in Mexico

Composed of three representatives each from Mexico and the United States, the International Water Commission began its second meeting at Mexico City on Tuesday. The first was held last year in the United States. The commissioners will endeavor to solve the problem of apportioning the waters of the Colorado, the Rio Grande and the Tia Juana River as between the two nations. Elwood Mead, Commissioner of Reclamation; W. E. Anderson and General Lansing H. Beach are the American members of the conference. General Estrada, Acting Minister of Foreign Relations, welcomed them to Mexico.

Niagara Falls Electric Rates Cut 10 per Cent

A new schedule of rates for Niagara Falls filed for approval with the New York Public Service Commission by the Niagara Electric Service Corporation provides a reduction in excess of 10 per cent to take effect September 4. The new schedule, which the company estimates will bring a saving of $110,000 a year to its customers on the basis of present consumption, substitutes the present Buffalo power rates for those now charged in Niagara Falls.

The rates in the latter city now are 5 cents per kilowatt-hour for the first 40 hours of monthly use, 4 cents for the next 120 kw.-hr. and 1½ cents for all over 160. The new rate would be 5 cents for the first 60 kw.-hr., 4 cents for the next 120 kw.-hr. and 1½ cents for any excess.

Under the old rate a 75-cent minimum was charged plus 25 cents per 1,000 watts for all devices of 750 watts capacity or more. The new schedule provides for a flat minimum of 75 cents. A change is to be made in the method of determining the demand per month. This is now based on the number of sockets, with a minimum of 500 watts. The new schedule reduces that to 25 per cent of the total number of lamp sockets rated at 10 watts each, with a minimum of 250 watts.

Pittsburgh Prepares for the Edison Jubilee

"Light's Golden Jubilee" will be observed in Pittsburgh during the week of October 21, according to plans announced by the Pittsburgh Chamber of Commerce. Under the general chairmanship of A. L. Humphreys, president of the Westinghouse Airbrake Company, the proposed celebration seems likely to become community-wide, surpassing anything previously projected in the city. F. R. Phillips, senior vice-president of the Philadelphia Company, has accepted the general vice-chairmanship.

It is planned to link this celebration with one which will honor great Pittsburghers like Andrew Carnegie, Henry Frick, H. J. Heinz and George Westinghouse. While specific phases of the celebration have as yet to be worked out, there will probably be a spectacular night parade followed by a pageant depicting "then-and-now" aspects of local development. Hundreds of buildings and homes will be floodlighted or otherwise appropriately decorated.

Oklahoma Thinks of a Unique Jubilee Plan

On the theory that "it is darkest just before dawn," Oklahoma will experience one of the darkest moments of its history on the evening of October 21 next. On that date, which is the fiftieth anniversary of the invention of the incandescent electric light by Thomas A. Edison, Oklahomans, in their homes, places of business, or wherever they may be, will be urged to use kerosene lamps or candles for illumination during a brief period preceding a prearranged moment when all electric lights will be turned on and the transformation effected for the world on October 21, 1879, will be demonstrated. Plans for this unique observance of the occasion are sponsored by the Oklahoma Utilities Association, which has enlisted the co-operation of citizens' and civic organizations of the entire state.

"Silver Jubilee" Program of Western Inspectors

A full program has been arranged for the twenty-fifth, or "Silver Jubilee," meeting of the Western Section of the International Association of Electrical Inspectors at the Book-Cadillac Hotel, Detroit, on Monday, Tuesday and Wednesday of next week. Committee and officers' reports will number about thirty, spread over the six sessions. On Thursday there will be tours of inspection for those who stay over and a dinner at the Prince Edward Hotel, Windsor, Ontario, across the river.

Speakers and contributors of papers include H. G. Nichols on meter-service entrance breakers, A. H. Meier and Dr. M. G. Lloyd on the bare grounded neutral, George Welman on small-town grounding problems, discussed by F. A. Cambridge; Joseph Gable on neon gas, J. C. Forsyth on the international association, J. G. Fisher on the ideal electrical code for the "tall grass" town, Arthur L. Abbott on adequate housewiring requirements, Victor L. Tousley on recent National Electrical Code amendments, and Thomas Templeton on the relations between the electrical contractor and the electrical inspector.

Fremont Wilson will clear up some of the confusion produced by sensational press notices concerning electrical refrigerator accidents in Chicago, and the solution of flexible-cord problems will be discussed by C. W. Abbott, R. C. Shepard, L. L. Johnson, J. C. Forsyth, Arthur P. Good and H. J. Mauger, Mr. Abbott describing the new standard, Mr. Shepard speaking for the Underwriters' Laboratories, Mr. Johnson for the municipal inspector, Mr. Forsyth for the underwriters' inspector, Mr. Good for the utility, and Mr. Mauger devoting his attention to heater cords and appliances.

Industry Sales Conference Survey Made

J. Walter Thompson Company Reports Results of Investigation That Covered 3,203 Homes in 23 Scattered Communities —Nearly Half Want More Appliances

RESULTS of the survey of the American residential market for electric service, conducted for the Industry Sales Conference by the J. Walter Thompson Company, have just been made public through the Society for Electrical Development. This survey was preliminary to the launching of a nation-wide campaign to increase the use of electricity in the home, for which plans are now complete. It is confidently expected to increase the total national consumption of energy far above the levels at present prevailing.

The survey covered 3,203 typical homes in 23 communities situated in seventeen states in all parts of the country and also the Province of Ontario. The cities and towns visited were carefully selected to give a cross-section of populations of from more than 500,000 down to 5,000. They were selected to mirror conditions in mill towns, farming territories, city areas, general manufacturing sections and so on. The homes visited in each of these cities were carefully selected to reflect varying buying power of different families. Results were checked by a mail canvass in 21 cities parallel in characteristics to those in which the personal canvass was made.

This project is the culmination of a year and a half's effort by the Industry Sales Conference to determine (1) the adequacy with which typical American homes are wired as gaged by the minimum "red seal" standard of the Society for Electrical Development; (2) the number and nature of electrical appliances in the typical household; (3) the extent of consumer interest in and appreciation of the value of electricity; (4) ways and means to develop a large market for electricity in the homes of America.

The first step was investigation into the co-operative promotional methods used by other industries serving the home. This study, which embraced more than twenty industries, revealed that many of them engage extensively in co-operative promotion and that sums aggregating in excess of $20,000,000 are expended annually for this purpose. The study also revealed that the national manufacturers whose products and trademarks are known in almost every household base their operations on consumer studies and intimate analyses of the market.

Relative Use of Appliances

In the J. Walter Thompson report appliances in each of the 3,203 homes visited are inventoried. Ninety-eight per cent of the homes were found to have the electric iron, 87 per cent the cleaner, 70 per cent the toaster, 46 per cent the washing machine and 32 per cent the percolator. All of the appliances named are used regularly, except the percolator, which is reported to be used occasionally, about 40 per cent of the time.

Of the principal health and comfort appliances, the ordinary portable lamp, found in 98 per cent of the homes, was the only device in regular use. The curling iron was found to be used regularly only in half the homes that had them, the fan used regularly in one-third and the radiant heater in 50 per cent.

Taking all the appliances of all kinds found in all the homes, the irons, which numbered 14 per cent of the total number of appliances in use, accounted for 22.5 per cent of all the energy used by the appliances. The refrigerators, although only in 3.9 per cent of the homes, accounted for virtually 30 per cent; the cleaners, found in approximately 20 per cent of the homes, accounted for 5.6 per cent of the energy. Although ranges numbered only 1.9 per cent of all the appliances, they accounted for 23.3 per cent of all the energy used.

Of 3,179 housewives interviewed, only 30 per cent wanted to improve their wiring, but 46 per cent expressed the desire to do more of their housework with electricity. Housewives show much greater interest in appliances than they do in wiring.

Of 1,449 women who expressed the desire for more appliances, 37 per cent wanted refrigerators, 22 per cent elec-

tric ranges, 20 per cent washing machines and 20 per cent ironing machines. The reason given by these women why they had not bought more appliances was, in 58 per cent of the cases, the fact that cost of appliance and installation were beyond their allowance; 16 per cent of the reasons given stated that the cost of electricity was too much.

Simultaneously with release of this information, which represents only a part of the whole plan for determining and reaching the market, W. W. Freeman, president of the Society for Electrical Development, announced on behalf of the society's directorate that the campaign plan of the Thompson company as submitted by a special directors' committee to the directors themselves has been approved in principle, with instructions to complete the national advertising copy, supporting literature and the local tie-in plans. The special committee also was instructed to submit the completed plans to the several associations of the industry, make recommendations as to financing and proceed to arrange for the underwriting of the national fund.

The recommended plan, it is understood, involves "selling" the idea of a completely wired home to the real estate operator, the builder and the electrical contractor as a substitute for the policy of selling the individual appliance to the housewife.

Large Decline in Municipal Electric Stations

The semi-annual supplement to "Government (Political) Ownership and Operation and the Electric Light and Power Industry," which has lately been issued by the National Electric Light Association, contains records of 1,440 cities and towns, with a total population of 2,999,615, where municipal operation has disappeared and the communities are now served from company distributing systems.

The records also show that 498 municipal systems, serving a present total population of 1,603,864, which at one time operated their own power plants have sold or discarded their generating plants to buy electricity wholesale from the systems of private companies.

A. F. of L. Will Have Its Own Utilities Inquiry

Influenced by the trouble in New Orleans between the New Orleans Public Service, Inc., and its street-railway employees, the executive council of the American Federation of Labor, in session at Atlantic City, issued this statement on Tuesday:

In view of this attitude of the public utility corporation at New Orleans toward labor and the adjustment of labor controversies, the executive council directs the officers of the American Federation of Labor to conduct an investigation of the policies of public service corporations, including holding companies, in order to determine their general attitude toward labor and the settlement of labor disputes. The future attitude of the American Federation of Labor toward public service corporations and holding companies will be determined in the light of such facts as said investigation may disclose.

Purchases and Mergers

Columbus (Ga.) Company Now Part of Southeastern Power & Light System —New York State Electric Corporation Seeks Elmira Utility

THE conditional offer for the common stock of the Columbus (Ga.) Electric & Power Company made by the Commonwealth & Southern Corporation, as noted in these columns on July 6, was accepted by the stockholders, and the Columbus company is now a subsidiary of that holding organization and allied with the Georgia Power Company and other constitutent concerns of the Southeastern Power & Light. The Columbus Electric & Power, which was previously under Stone & Webster management, itself controlled the South Georgia Power Company, serving Albany, Americus, Cordele and more than thirty other Georgia towns.

The Elmira Water, Light & Railroad Company has petitioned the New York Public Service Commission to transfer its franchises and electric and gas plants to the New York State Electric Corporation. The commission will give a hearing on the application. The New York State Electric Corporation has its principal office in Ithaca, and it proposes to cover the territory of the Elmira company as one property. Consent has also been asked by the Wayland Light & Power Company, which operates in Lancaster, N. Y., for authority to transfer its franchises and system to the New York State Electric Corporation.

A certificate filed in the office of the Secretary of State of New York states that the International Power & Transmission Company, Lockport, has been merged with the Lockport Light, Heat & Power Company, by which it had been controlled.

Authorization was announced this week by the Public Service Commission of Vermont of the consolidation, under the name of the Central Vermont Public Service Corporation, of seven Insull-owned power Companies in that state. The companies merged are the Vermont Hydro-Electric Company, Rutland Railway, Light & Power Company, Pittsford Power Company, Public Service Corporation of Vermont, Middlebury Electric Company, Windsor Electric Light Company and the Bradford Electric Light Company. More than ninety towns will be served by the new corporation, all the stock in which is owned by the New England Public Service Company.

The Columbia Gas & Electric Corporation has acquired more than 75 per cent of the preferred and 85 per cent of the common stock of the Cincinnati, Newport & Covington Light & Traction Company, an allied organization.

The Southern Ohio Electric Company of Athens has asked the Ohio Public Utilities Commission for authority to purchase the Ohio Utilities Company of Columbus and the Chillicothe Electric Railway, Light & Power Company at valuations which the commission had previously fixed on the properties. When the Southern Ohio Electric Company applied last March for permission to purchase the Ohio Utilities Company for $2,277,520 and the Chillicothe concern for $748,000, the commission denied the application on the ground that the prices were too high and fixed $2,230,740 as the price for the Ohio company and $641,828 for the Chillicothe company.

An Insull subsidiary, the Midland Utilities Investment Company, has acquired control of the General Utilities Company, which supplies electric service to twelve communities in southern Indiana and owns about 85 miles of transmission and distribution lines interconnected with the Interstate Public Service system.

Authority has been granted to the Kansas City (Mo.) Power & Light Company to purchase the Pioneer Light & Power Comany in Chariton County for $5,000.

Citizens of the town of Hastings, Okla., recently voted to sell the local electric distribution system to the Southwestern Light & Power Company. Only one vote was cast in opposition. The company recently acquired distributing systems in the towns of Hydro and Texola.

The Otter Tail Power Company has been authorized to buy the Erie (N. D.) lighting plant.

Plants at Ridgely, Tiptonville, Wynnburg and Dover, Tenn., are reported to have been bought by the Kentucky-Tennessee Light & Power Company of Bowling Green, Ky. The company is also reported to have bought eight small properties in Missouri.

The City Council of Martinsville, Va., has refused to entertain an offer from the Appalachian Electric Power Company for the purchase of the city's water, light and telephone plants for $850,000.

The Roaring Gap (N. C.) power system has been sold to the Northwest Carolina Utilities Company of West Jefferson, N. C.

A resolution has been passed by the Winnfield (La.) Town Council agreeing to submit an offer of $160,000 for the municipal light and water system by Swanson-McGraw of New Orleans to the voters.

Official Ticket Selected for S.E.D. Directors

Below is the official ticket of the nominating committees for directors of the Society for Electrical Development. The election will be held at the annual meeting on September 13, in the society's offices, New York.

To represent central-station group: One year, M. S. Sloan, M. E. Sampsell, Paul S. Clapp; three years, Charles L. Edgar.

To represent manufacturer group: One year, H. B. Crouse, A. E. Waller, W. E. Sprackling; three years, Gerard Swope.

To represent wholesaler group: One year, G. E. Cullinan, E. Donald Tolles, John L. Buchanan; three years, Edwin M. Keatley.

To represent contractor-dealer group: One year, C. L. Chamblin, L. W. Davis, S. C. Blumenthal; three years, C. M. Beltzhoover.

To represent "at-large" group: One year, F. D. Gill; three years, James H. McGraw.

To represent local electrical leagues: One year, R. B. Corcoran, D. C. Birdsell, J. E. North, J. H. Van Aernam; three years, H. H. Courtright.

Federal Power Commission Still Kept Busy

Colorado River Controversies Not Over —Columbia, Lewis, Willamette, Roanoke and Other Streams Supply Sites for Seekers of Licenses or Permits

PASSAGE of the Swing-Johnson bill has diminished in no sense certain of the controversial features pertaining to the development of the Colorado River. The demand that no rights be granted on that river or its tributaries is as strong as ever. On the other hand, those whose projects have been held in abeyance for years are anxious to proceed with them as is provided in the water-power act. This is particularly true with regard to the projects on the Gila River. A number of constructed projects in the Colorado River watershed are anxious to have their occupancy of public lands legalized. As Congress has specifically and definitely lifted the ban which it laid upon projects in the watershed while the bill was pending, it is assumed that the Federal Power Commission would feel that it would be taking a good deal upon itself to withhold action further.

The commission has authorized the issuance of a preliminary permit to the Washington Electric Company of Seattle covering an initial installation of 72,000 hp. and an ultimate installation of 192,000 hp. on the Columbia River in Chelan and Douglas Counties, Wash. A preliminary permit also has been issued to the Inland Power & Light Company of Portland covering its 170,000-hp. project on Lewis River. In each of the foregoing cases provisions are to be included in the license, if issued, for the protection of navigation and fish migration.

The city of Vancouver, Wash., has applied to the Federal Power Commission for a preliminary permit covering a proposed development on the North Fork of Lewis River one-half mile above the mouth of Swift Creek. It is proposed to install 80,000 hp. The primary power available is 32,000 hp.

L. E. Bryant of Roberta, Tenn., has obtained a preliminary permit covering a project on Rockcastle and Laurel Rivers in Kentucky. An application of John A. Shafer conflicting with that of Mr. Bryant was rejected on the ground that the Bryant plan involved a more comprehensive development.

The commission has decided not to take jurisdiction in the development proposed by John A. Reed of Cedar Rapids on the Des Moines River near Evanston, Iowa.

The Portland Electric Power Company and the Crown Willamette Paper Company have 90 days to indicate why their application for license covering a partly constructed 7,200-hp. project on the Willamette River should not be rejected. A license covering this project was authorized March 2, 1925, but the applicants have never accepted it.

A transfer of the license issued to Walter Cravens on the Osage River in Missouri to the Missouri Hydro-Electric Power Company and the Union Electric Light & Power Company has been authorized.

The Virginia-Carolina Power Company of Roanoke Rapids, N. C., has applied to the commission for a license covering a 33,000-hp. development on the Roanoke River, in Halifax and Northampton Counties, N. C. It is proposed to construct a dam above Roanoke Rapids at about the location of the existing diversion dam, creating a reservoir seven miles long. Ultimately it is planned to install 55,500 hp. The power is to be sold to the Virginia Electric & Power Company. This application for license applies to one of the developments covered by the preliminary permit issued the applicant on July 10.

The city of Allegan, Mich., has applied for a license for the project covered in the preliminary permit issued the city August 27, 1928. The proposed development includes a dam and power house at Calkins Bridge as well as a transmission line six miles long to the town. It is planned to install equipment sufficient to develop 2,000 hp.

Joint Conference Committee on Heater-Cord Sets

Under the chairmanship of H. J. Mauger, chairman of the N.E.M.A. Heating Device Section, a joint conference committee of manufacturers' and underwriters' representatives met recently to discuss informally the question of the sale of inferior or sub-standard heater cords and plugs which cause dissatisfaction to central-station customers and often result in the disuse of appliances. A standard was sought which would be in keeping with the particular service required of the flatiron—constant motion under high-temperature conditions. The need to discriminate between sets for flatirons and sets for other heating appliances was pointed out, the latter giving much less trouble.

It appeared from the discussion that the industry conference is faced with five main problems: (1) quality of the cord itself, to give satisfactory life; (2) quality of the plug with regard to durability of structure and contacts; (3) relationship of cord and plug to each other and to the appliance; (4) interchangeability of plugs; (5) quality of plug cap which goes in wall outlet.

A report of an investigation by the Hartford Electric Light Company showed that 85 per cent of cord breakage is at or near the plug. Tests of cold-molded plug halves indicated a wide variation of strength, both cold and after being heated for 48 hours at 570 deg. F. The best plug was nearly nine times and the next best six times as strong as the poorest. After being heated some plugs greatly deteriorated.

It was the sense of the meeting that merely setting up underwriters' standards would not correct the evil of sub-standard material. Education first of the trade and then of the public is necessary. It was agreed as a first step that a make-and-break test should be made on virtually all of the plugs on the market, that data on the strength of these plugs should be assembled and that a study should be made of the temperature conditions for appliance plugs as well as flatiron plugs. It was further agreed that sample cord sets be submitted by the manufacturers to the conference for study and that central stations be asked for any tabulated data which their service departments may be able to get together.

All Plans Complete for Coast Meeting of A.I.E.E.

With an ideal meeting place, the Miramar Hotel at Santa Monica, 15 miles from Los Angeles; a diversified technical program, ample provision for sports, bathing and fishing, and trips to points of interest by motorcar and airplane, the outlook for the Pacific Coast meeting of the American Institute of Electrical Engineers on September 3 to 6 leaves nothing to be desired. Two students' sessions will be held, one on the afternoon of Tuesday, September 3, and the other on Thursday morning. Wednesday will be given over to trips and golf. In the evening of that day an address on "Recent Developments in the Theory of Electrical Conductivity" will be given by William V. Houston, California Institute of Technology. President H. B. Smith will preside at the banquet on Thursday evening.

Proceedings for the technical sessions have been arranged as follows:

TUESDAY, SEPTEMBER 3

Morning.—"Radio Interference from Line Insulators," E. Van Atta, Pacific Power & Light Company, and E. L. White, Puget Sound Power & Light Company; "Spray and Fog Tests on 220-Kv. Insulators," R. J. C. Wood, Southern California Edison Company; "The 60-Cycle Flashover of Long Suspension Insulator Strings," R. H. Angus, Stanford University; "Impulse Insulation Characteristics of Wooden-Pole Lines," H. L. Melvin, Electric Bond & Share Company.

THURSDAY, SEPTEMBER 5

Afternoon.—"Development of Insulating Oils," C. E. Skinner, Westinghouse Electric & Manufacturing Company; "Effect of Tank Color on Temperature of Transformers Under Service Conditions," V. M. Montsinger and L. Wetherill, General Electric Company; "Population as an Index to Electrical Development," N. B. Hinson, Southern California Edison Company; "Flame from Electric Arcs," J. Slepian, Westinghouse Electric & Manufacturing Company; "Design Features That Make Large Turbine Generators Possible," W. J. Foster and M. A. Savage, General Electric Company.

FRIDAY, SEPTEMBER 6

Morning.—"Effect of Surges on Transformer Windings," J. K. Hodnette, Westinghouse Electric & Manufacturing Company; "An Alternating-Current Low-Voltage Network Without Network Protectors," L. R. Gamble and Earl Baughn, Washington Water Power Company; "Development of Low-Current, High-Voltage Fuses," Roy Wilkins, Pacific Electric Manufacturing Corporation; "Electrical Control Features of Wind Tunnel at California Institute of Technology," W. A. Lewis, Jr., California Institute of Technology.

Afternoon.—"Electrical Engineering of Sound-Picture Systems," T. E. Shea, Bell Telephone Laboratories, and K. F. Morgan, Electrical Research Products Corporation; "Dial Telephone System Serving Small Communities of Southern California," F. O. Wheelock, Southern California Telephone Company; "Parallel Operation of Transformers Whose Ratios of Transformation Are Unequal," Mabel Macferran, Southern

California Edison Company; "Progress in the Study of System Stability," I. H. Summers and J. B. McClure, General Electric Company; "Synchronous Generation of Voltage Consumed by Line Inductance," T. H. Morgan, Stanford University.

Briefer News

NEW BOILER FOR COLORADO PUBLIC SERVICE COMPANY.—The Public Service Company of Colorado will spend $600,000 for a 3,750-hp. boiler and new pulverizing equipment to increase the output of its Denver generating plant.

NEW TRANSMISSION LINE FOR NORTHERN ILLINOIS. — The Illinois Northern Utilities Company is to build a 25-mile stretch of 33,000-volt transmission line this fall extending from Ohio, Ill., to connect with the Prophetstown and Geneseo lines.

TENNESSEE ELECTRIC POWER COMPLETES CENTERVILLE EXTENSION.—The Tennessee Electric Power Company's 45-mile high-tension transmission line from Nashville to Centerville, with a new substation, which formed part of the company's 1929 construction program, has gone into operation. The extension represents an expenditure of about $1,000,000.

URBANA, OHIO, GIVES UP MUNICIPAL PLANT IDEA.—The Mayor of Urbana, Ohio, has signed an ordinance granting the Ohio Edison Company a five-year contract and a ten-year franchise under which it will furnish the city with light and power. Thus ends, at least for the present, a two-year fight for a municipal light plant, backed by the Mayor and a group of councilmen.

REBUILDING OF INDEPENDENCE (MO.) MUNICIPAL PLANT COMPLETED. — The Mayor of Independence, Mo., announces the completion of the improvements to the municipal electric plant, which embraced the installation of a 2,500-kw. turbo-generator and auxiliaries, including a 500-hp. boiler and a transmission tower, at a total cost of $135,000.

LIGNITE-CONSUMING GENERATING PLANT PROPOSED FOR ROCKDALE, TEX.—Tentative plans for the construction of a large electric power plant in the lignite district near Rockdale, in central Texas, are being considered by the Texas Power & Light Company, according to information received by the Rockdale Chamber of Commerce, which thinks that the inexhaustible supply of good-quality lignite adjacent to Rockdale should influence the company in a favorable decision.

BINGHAM (ME.) HYDRO PROJECT STARTED.—The Central Maine Power Company has 1,000 men employed on its hydro-electric project at Bingham, Me. A cofferdam has been constructed on the west bank of the Kennebec River to change the course of the river. The power dam will be 2,810 ft. long, the concrete spillway 500 ft. long and the intake section 160 ft. Operating head will be 135 ft. and there will be three generating units of 34,000 hp. each. The plant will represent an outlay of $10,000,000 and be one of the largest hydro-electric developments in New England. An artificial lake 10 miles long will be created.

FINAL APPLICATION FILED FOR ROANOKE RIVER PROJECT. — W. E. Wood, president Virginia Electric & Power Company, announces that the final application for license covering a 33,000-hp. hydro-electric development on the Roanoke River has been filed with the Federal Power Commission. Construction is expected to start on the project some time next year, and its ultimate capacity will be 55,500 hp.

TEXAS-LOUISIANA POWER COMPANY ASKS FRANCHISE IN YOAKUM.—Application has been made to the City Council of Yoakum, Tex., by the Texas-Louisiana Power Company for a franchise for 40 years to supply the town with electric light and power. If the franchise is granted, the company will, it is stated, construct an electric power plant at Yoakum, to cost $250,000.

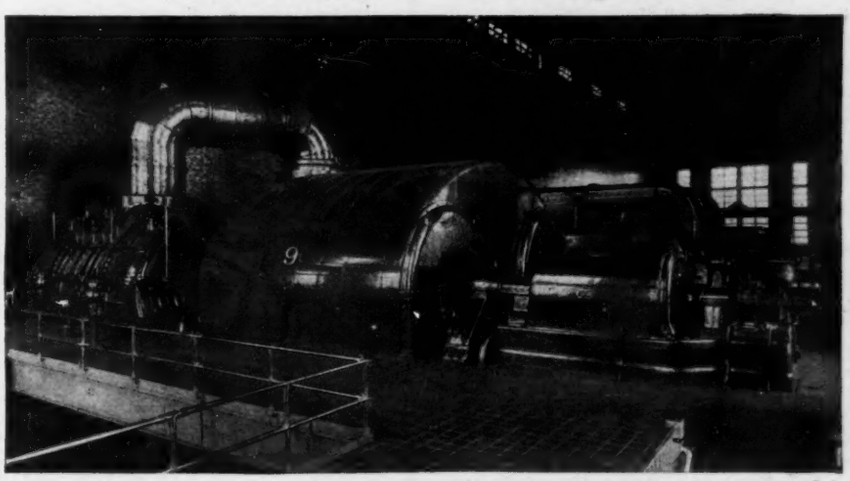
TACOMA SEEKS STATE LAND FOR NEW CUSHMAN POWER PLANT. — A condemnation suit has been launched by the city of Tacoma in Mason County, Wash., with the purpose of taking over almost 60 acres of state land for use in the development of the second unit of the Cushman power project. Papers filed in the suit by E. K. Murray, corporation counsel, declare that Tacoma now urgently needs more electrical energy than is provided by the existing unit and that the city will find it necessary to purchase energy or manufacture it in a steam plant at exorbitant cost until the additional unit is available. The property involved is along the shores of the Skokomish River, the waters of which are to be used in the development.

WESTINGHOUSE LIGHTING INSTITUTE PREPARES FUNDAMENTAL ILLUMINATION COURSE.—An illumination course especially planned for the beginner is announced by the Westinghouse Lighting Institute, Grand Central Palace, New York, for September 19-21. Among the subjects covered will be "sources of light," "light and the process of seeing," "reflecting materials and their applications," "design of lighting installations," "home lighting," and "measurement of light." Inspection trips on the streets and to lamp works will add to the practical nature of the course.

HYDRO-ELECTRICITY IN THE PHILIPPINES.—The Associated Gas & Electric Company has started construction on its hydro-electric project in the Philippine Islands. This plant, which will have a head of 635 ft., will be built on the Bogotan River, about 50 miles from Manila. Current will be transmitted over a steel-tower transmission line at a voltage of 110,000, said to be the highest in the entire Orient. The initial capacity will be 25,000 hp. The power to be generated will take care of the major portion of the electric requirements of Manila and the adjacent and intervening territory and will be augmeted by steam-generated power at peak loads.

CAYUGA LAKE (N. Y.) LEVEL AND OSWEGO RIVER HYDRO PLANTS.—Industrial and power men were in Ithaca, N. Y., recently conferring with munic-

Hell Gate's 165,000-Kw. Westinghouse Unit



HELL GATE, the mammoth generating station of the United Electric Light & Power Company of New York, has installed as its latest generating unit the 165,000-kw. two-cylinder, cross-compound Westinghouse machine shown above, a full description of which was printed June 1 (page 1089).

ipal officials on the level of Cayuga Lake and its effect on the power companies having plants along the Oswego River. Mayor Fred Howe will appoint a committee to discuss the matter further with power-company officials and devise a plan whereby the normal level of Cayuga Lake may be maintained the year around and the normal water supply for Oswego River plants be available.

WILLISTON, N. D., DEFEATS MOVEMENT OPPOSED TO CENTRAL-STATION SERVICE.—An entire citizens' committee ticket favoring granting of a franchise to the Montana-Dakota Power Company was elected to office at a special election at Williston, N. D., August 9. Three city commissioners were ousted at the polls following their refusal to allow a vote on the franchise proposal, and the presidency of the commission went to a supporter of the franchise by 700 majority.

SIXTY-SIX-MILE, 110-KV. TRANSMISSION LINE NOW SERVES NORTH MISSISSIPPI.—The 110-kv. transmission line recently completed from the Gorgas plant of the Alabama Power Company to the primary substation of the Mississippi Power Company north of West Point, Miss., adds an important link in the transmission network of the latter company. The line is 66 miles long and is designed to serve north Mississippi, where the load is four times larger than it was three years ago.

MISSOURI COMMISSION WILL EVALUATE KANSAS CITY POWER & LIGHT.—The Missouri Public Service Commission has ordered an appraisal of the property of the Kansas City Power & Light Company for rate-fixing purposes, hearings to begin about September 1. There has been no appraisal and valuation of the electric property since 1918, at which time it was valued at less than $7,000,000 on a depreciated basis. It has been mounting continually since that time, and the last report of the company claims a valuation of more than $49,000,000 as of December 31, 1928. The present electric rates have been in effect since September 1, 1927. It probably will require five or six months to complete the work of appraisal.

FOUNDATIONS UNDER WAY FOR POWERTON ADDITION.—The open cofferdam method is being used by the L. E. Myers Company in excavating for the foundation of the addition to the Insull steam generating station at Powerton, Ill., part of which will extend below ground water level. This addition is designed for two 105,000-kw. turbo-generators, though only one will be installed at first. When the Powerton plant is finished it will have a total capacity of 320,000 kw. The Central Illinois Public Service Company has started work on a 33,000-volt transmission line between Havana, Ill., and Powerton. Work has also been started on a steel-tower river crossing at Havana.

DOOMED VILLAGE FAILS TO PREVENT OSAGE RIVER DEVELOPMENT.—The last obstacle to the Union Electric Light & Power Company's construction of a hydro-electric dam and power plant at Bagnell, Mo., on the Osage River, was removed when the Missouri Public Service Commission on August 9 overruled a motion by the village of Linn Creek, Mo., for a rehearing on the commission's order authorizing the power company to take over the project. The site of the village will be overflowed by the reservoir.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue of July 6, page 46.]

International Association of Electrical Inspectors, Western Section—Book-Cadillac Hotel, Detroit, Aug. 26-28. W. S. Boyd, 175 W. Jackson Blvd., Chicago. International convention, Vancouver, B. C., Canada, Sept. 9-11. F. D. Weber, P.O. box 745, Portland, Ore.

National Association of Railroad and Utilities Commissioners—Glacier National Park, Mont., Aug. 27-30. J. B. Walker, 270 Madison Ave., New York.

Rocky Mountain Division, N.E.L.A.—Hotel Colorado, Glenwood Springs, Colo., Sept. 2-4. O. A. Weller, Public Service Co. of Colorado, Denver.

Colorado Utilities Association—Glenwood Springs, Colo., Sept. 2-4. O. A. Weller, Public Service Co. of Colorado, Denver.

American Institute of Electrical Engineers—Pacific Coast convention, Santa Monica, Calif., Sept. 3-6. F. L. Hutchinson, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs Hotel, Bedford Springs, Pa., Sept. 4-6. H. A. Buch, Telegraph Building, Harrisburg, Pa.

Association of Edison Illuminating Companies—Chateau Frontenac, Quebec, Sept. 9-12. P. S. Millar, 80th St. and East End Ave., New York.

New England Division, N.E.L.A.—Hotel Griswold, New London, Conn., Sept. 9-12. Miss O. A. Bursiel, 20 Providence St., Boston.

Empire State Gas and Electric Association—Electric Meter Section, New York Edison Auditorium, New York, Sept 12-13; annual meeting, Saranac Inn, Saranac Lake, N. Y., Sept. 19-20. C. H. B. Chapin, Grand Central Terminal, New York.

American Electrochemical Society—Hotel William Penn, Pittsburgh, Sept. 19-21. C. G. Fink, Columbia University, New York.

Illuminating Engineering Society—Bellevue-Stratford, Philadelphia, Sept. 24-27. A. B. Oday, 29 West 39th St., New York.

Great Lakes Division, N.E.L.A.—French Lick Springs, Ind., Sept. 26-28; Engineering Section, Lorain Hotel, Madison, Wis., Oct. 23-26. T. C. Polk, room 110, 140 South Dearborn, St., Chicago.

American Electric Railway Association—Atlantic City, Sept. 30-Oct. 4. J. W. Welsh, 292 Madison Ave., New York.

Association of Electragists International—New Ocean House, Swampscott, Mass., Sept. 30-Oct. 3. L. W. Davis, 420 Lexington Ave., New York.

National Safety Council—Stevens Hotel, Chicago, Sept. 30-Oct. 4. W. H. Cameron, 108 East Ohio St., Chicago.

National Electrical Manufacturers' Association—Wardman Park Hotel, Washington, Oct. 7-11. S. N. Clarkson, 420 Lexington Ave., New York.

American Society of Mechanical Engineers—National fuel meeting, Bellevue-Stratford Hotel, Philadelphia, Oct. 7-10. C. W. Rice, 29 West 39th St., New York.

American Engineering Council—Mayflower Hotel, Washington, Oct. 24-25. L. W. Wallace, 26 Jackson Place, Washington, D. C.

LIGHTNING HITS ST. PETERSBURG PLANT BUT SERVICE GOES RIGHT ON.—In a recent severe lightning storm, the 12,500-kw. generating unit in the St. Petersburg steam plant of the Florida Power Corporation was badly damaged. At the time this unit was carrying virtually one-half of the entire load for the Georgia-Florida system, but no interruption or curtailment of service occurred at any point on the system. The other plants by able manipulation picked up the load and held it until another machine was obtained to replace the damaged unit. Had it not been for the interconnections of this system a serious interruption to service would have occurred.

YONKERS (N. Y.) RATES GO DOWN.—The maximum rate of the Yonkers (N. Y.) Electric Light & Power Company, one of the affiliated companies under the presidency of M. S. Sloan, will be reduced from 10 cents a kilowatt-hour to 8 cents, beginning October 1, making a saving of $200,000 a year for the consumers of the company, it is estimated. This reduction brings the Yonkers rate down to where it is only one cent higher than the prevailing rate in New York City, the difference being due to the cost of transmission. The five companies in the system are now on an equal basis as to rates, the cost of furnishing service being taken into account.

ELECTRIC ASSOCIATION OF CHICAGO HEARS HUGH P. BAKER—At its regular quarterly luncheon on August 15 the Electric Association of Chicago was addressed by Hugh P. Baker, manager of the trade association department of the United States Chamber of Commerce, who spoke on the functions and opportunities for service of trade organizations. Mr. Baker also dwelt on the legal limitations surrounding the activities of such associations and said that public opinion regarding the morality of their purposes had changed greatly from the days of "trust busting" and of suspicion that any coming together of trade interests must necessarily mean a raid on the purses of the consuming public.

SPREAD OF RURAL HIGHWAY LIGHTING IN NEW YORK STATE.—Steps to duplicate in Onondaga County, N. Y., of which Syracuse is the chief city, the rural highway lighting system inaugurated by Monroe County, served from Rochester, as part of a movement to extend the improvement across the state, have been taken, Onondaga supervisors inspecting the Rochester network under supervision of officials

of the Rochester Gas & Electric Corporation. Monroe County operates 16 miles of lighted rural highways. The system, managed by the utility company, was installed for $945 a mile and has been copied in other parts of the state. Aided by utility officials, a movement is under way to install a rural highway system all the way from Buffalo to Albany, with alternate lights 250 ft. apart.

THE PROVERBIAL MONKEYWRENCH MAKES TROUBLE AT SPRINGFIELD, MASS. —A monkeywrench in the machinery was the literal cause of trouble at Springfield, Mass., on August 15, when a wrench in the hands of a workman crossed a switch and produced a short circuit in the State Street plant of the United Electric Light Company. A complete shutdown for 43 minutes was followed by partial paralysis of the company's lines for several hours. Hard work by an emergency crew of 40 men restored full service early in the evening. The man who caused the accident was burned and a fellow-workman was temporarily overcome by fumes, but no fatalities resulted. Damage to the plant was between $5,000 and $10,000, officials estimated.

STANDARDIZING RATES IN NORTH DAKOTA.—Authority has been given by the Board of Railroad Commissioners of North Dakota to the Otter Tail Power Company to standardize its electric rates throughout that state. The company has filed one series of schedules applicable in cities of 2,500 or more population, another series applicable in towns of from 800 to 2,500, and a third series in towns of 800 or less. Eleven different schedules are contained in each series, consumers being given an option as to which schedule they prefer. In class A cities the residential lighting rate for the first 100 kw.-hr. is 8.5 cents and in class B cities 9 cents. In class C towns 12½ cents will be charged for the first 25 kw.-hr. and 9 cents for the next 75 kw.-hr. The second-step rate is 6 cents, 7 cents and 7 cents respectively in the three classes of towns.

"VAPSCO" COMPLETES ITS REMINGTON-OCCOQUAN LINE.—The Virginia Public Service Company has announced the completion of the last link of its 30-mile tie between Occoquan and Remington, which joins together all the plants of the company, as well as those of the Virginia Electric & Power Company. This completed ring feeder network is approximately 610 miles in length, and about 550 miles of it is built for operation at 66,000 volts or higher. The section just completed joins together the Ronceverte (W. Va.) steam station and the Alexandria (Va.) steam station by a trunk line 230 miles long. At Goshen, on this line, there is another line approximately 200 miles in length extending through southern Virginia to Roanoke Rapids, N. C., where the Virginia Electric & Power Company has a large hydro development, lines from which serve Norfolk, Petersburg, Richmond, Fredericksburg and Quantico and end at Occoquan. In October the company will put in service the 7,500-kw. Cushaw hydro-electric plant which it is building at Snowden on the James River.

COLLEGE DEGREE IN ILLUMINATION. —Stanford University is now ready to grant the degree of electrical engineering in illumination to any electrical engineering student who specializes in illumination work during his fifth and sixth years. After the formation of the School of Engineering at Stanford University, Dr. Harris J. Ryan, who was convinced of the importance and scope of the illumination work, made it, along with power generation, power transmission and communication, a division or specialty in which the sixth-year electrical graduate student might secure his engineering degree.

SOUTH CAROLINA POWER COMPANY EXTENDING LINES TO SUBURBAN DISTRICTS. — Suburban service by the South Carolina Power Company in the Charleston area has been much extended in the past two and one-half years, and rural lines have been built to supply dairies and farmhouses on James Island and on the Savannah-Charleston highway. The company has recently rebuilt the transmission lines through Mount Pleasant and Sullivan's Island and also reconstructed the distribution systems, and to improve the service to these sections still further plans are under way to run power lines from the city to Mount Pleasant across the new Cooper River bridge, replacing the submarine cables which have been in use for many years and giving the territory east of Charleston service as good as that rendered there.

Recent Court Decisions

CITY'S RESPONSIBILITY FOR DEATH CAUSED BY ELECTRIC SHOCK FROM UNGUARDED APPARATUS. — In Jamison vs. Kansas City a suit for damages was based on the death of a workman from injuries caused four months previously when he came into contact with electrical apparatus on top of a municipal pumping station. Affirming judgment for the plaintiff, the Kansas City Court of Appeals overruled a number of contentions made by the city. The court held (1) that the withdrawal of joint suits against the Kansas City Power & Light Company and others did not release the city if the co-defendants were not primarily liable for the injury; (2) that failure to guard high-voltage apparatus or to erect warning signs was a question of negligence for the jury, no matter how high a type of installation and material had been used; (3) that the fact that the body of the man was in juxtaposition to the installation was evidence of the cause of injury and the fact that he did not die for four months did not make a verdict of death from electrocution a matter of "building inference upon inference"; (4) that responsibility could not be evaded by the contention that the city in the conduct of the pumping plant was acting in a governmental capacity. (17 S.W. [2d] 621.)

SELECTMEN'S GRANT OF LOCATION TO ELECTRIC COMPANY, ONCE ACTED UPON, CANNOT BE REVOKED.—The Supreme Judicial Court of Massachusetts held, in Selectmen of Topsfield vs. Department of Public Utilities, in a case affecting the Eastern Massachusetts Electric Company, that a revocation by the selectmen of a grant of location to the company before its acceptance by the company was invalid, since the company, in reliance on the selectmen's action, had, after the grant and before its revocation, acquired various parcels of land for the construction of transmission lines and had accepted certain restrictions and conditions confirmed by the Department of Public Utilities. (166 N.E. 739.)*

Commission Rulings

REFINANCING FORBIDDEN WHERE REPRODUCTION COST MIGHT EXCEED CAPITALIZED ORIGINAL COST.—The California Railroad Commission forbade the Coast Counties Gas & Electric Company to refinance its properties, on the ground that the reproduction cost new might exceed the original cost which the commission had previously permitted to be capitalized through the issue of stocks and bonds.

PENNSYLVANIA COMMISSION RULES OUT COMPLAINT MADE IN THE CAPACITY OF SHAREHOLDER.—A customer of and small shareholder in the Williamsport Water Company complained to the Pennsylvania Public Service Commission in both capacities, alleging that the directors of the company had burdened it with unnecessary fixed charges. The commission, viewing him as a consumer, pointed out that both the consumer's interest and the commission's jurisdiction over the internal capital structure of a utility are strictly limited to the possible effect of such arrangements on the rates and service of the company. In other words, as long as a utility can render good service at fair rates its internal organization is its own business. Concerning the complainant's intrusion of his status as a shareholder the commission said: "This commission was created and now exists for the regulation of one particular type of corporation, namely, a corporation engaged in the public service, in its relation with the public which it serves. With the corporaton's internal structure and the relations of its members among themselves this commission can have no interest except in so far as they affect the company's ability to fulfill its corporate duties to the public. The power to regulate the issuance of corporate stocks and bonds as such has not been placed within our jurisdiction. If complainant is of the opinion that his rights as a minority stockholder have been invaded, he has his remedy in the equity side of the Court of Common Pleas. To the extent that the complaint attacks respondent's proceedings from the point of view of a stockholder, it must be dismissed for want of jurisdiction."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

F. R. George to Direct Electrical Operations

F. R. George, since 1920 engineer of operation for the Pacific Gas & Electric Company, with headquarters in San Francisco, has been appointed engineer of electrical operation in charge of operation and maintenance of the company's electric, water and steam properties and of general line construction. The promotion was earned by Mr. George through his executive ability displayed in the operation of one of the largest interconnected hydro-electric systems in the world, according to the company's announcement, as well as his intimate knowledge of the company's properties gained through 28 years of service. Mr. George began his career in the electrical industry as an operator for the Mutual Electric Light Company in San Francisco. About 1901 he was employed by the Bay Counties Power Company, which eventually became a part of the Pacific Gas & Electric Company. In 1906 Mr. George was given the title of load dispatcher and pioneered in the organizing of the company's load-dispatching system, which has developed into an essential part of the company's extensive electric operations. He continued in that position until 1920, when he was placed in charge of the operation of the electric properties with the title of engineer of operation.

For years Mr. George has taken keen interest in technical matters, having served on national committees of both the National Electric Light Association and the American Institute of Electrical Engineers, and as chairman of the San Francisco Section, A.I.E.E., was one of the organizers of the San Francisco Engineering Societies' employment service. At the present time he is chairman of the engineering section of the Pacific Coast Electrical Association.

HUGH C. THUERK, formerly manager of the Erie Lighting Company, has been appointed manager of power sales for the Associated Gas & Electric system with headquarters in New York City. Mr. Thuerk went to Erie as special engineer for the northwest region of the Penn Public system in December, 1923. In the spring of 1926 he was appointed manager of power sales for the region and a year later he became operating manager of the Erie Lighting Company. Last year he was named manager. Mr. Thuerk has been active in the National Electric Light Association and at present is chairman of the general power committee. For the past year he has also been chairman of the commercial section of the Pennsylvania Electric Association. He is a contributor to the latest edition of the Encyclopædia Britannica, having written the American supplement on "Electrification of Industry."

STEPHEN C. BUNTING has been appointed resident manager of the Fort Plain district of the New York Power & Light Corporation, comprising Fort Plain, St. Johnsville, Canajoharie, Cherry Valley and Sharon Springs, N. Y. For the past several years Fort Plain and St. Johnsville were grouped together, with John D. Cairns of St. Johnsville as resident manager.

W. S. BARKER has been appointed purchasing agent of the Connecticut Power Company, with headquarters at Hartford, Conn., where he is also purchasing agent of the Hartford Electric Light Company.

JAMES P. MCCARRON has been appointed electrical engineer of the Hampshire Electric Company, recently acquired by the Western Massachusetts Companies. C. F. MOSHER has been named general superintendent of generation and distribution.

S. M. Kintner Appointed to Head A.I.E.E. Committee

S. M. Kintner, who was appointed chairman of the research committee of the American Institute of Electrical Engineers, as announced in the August 10 issue of the ELECTRICAL WORLD, has been manager of the research department of the Westinghouse Electric & Manufacturing Company for the past seven years. Mr. Kintner has been identified with the Westinghouse company since 1903, when he relinquished some academic work in which he was engaged to undertake research work for the Westinghouse interests. He resigned later to become general manager of the National Electric Signaling Company, the function of which was to perfect Professor Fessenden's radio inventions. In 1920 he sold this company to the Westinghouse company and again returned to the Westinghouse organization as the head of the research activities. Mr. Kintner is a native of Indiana and a graduate of Purdue University. In the course of his career he has been connected with the staff of the Western University of Pennsylvania and with the University of Pittsburgh.

J. H. Lawrence Elected President Thomas E. Murray, Inc.

At a meeting of the directors of Thomas E. Murray, Inc., held August 16 John H. Lawrence, vice-president and manager of the company since its organization, was elected president. Following graduation from Cornell University, Mr. Lawrence was employed in the engineering department of the New York Edison Company. In 1919 the late Thomas E. Murray, in order to consolidate the various consulting engineering activities he had engaged in for many years, formed the company which bears his name and selected Mr. Lawrence as active head in charge.

Mr. Lawrence has long been recognized as an authority on power plant design. His analytical method of determining the most economical plant focused attention upon the importance of the heat balance calculation as a preliminary in the rational solution of the design. He was one of the first to develop and apply this method, which has since been adopted in designing all leading plants. He has contributed largely to the advance in power plant design which has been made in recent years and which has resulted so materially in reducing the cost of power production. Mr. Lawrence is the holder of many patents covering improvements in power plants. He has presented many papers before engineering societies, dealing chiefly with various phases of power plant design and construction, and has been a lecturer in the engineering school at Cornell University. Mr. Lawrence has been active in various engineering societies, having served on many important committees. He is a member of the power generation committee of the American Institute of Electrical Engineers and a vice-president and a member of the executive committee of the American Society of Mechanical Engineers, having also served in the capacity of chairman of the professional divisions and as chairman of the Metropolitan Section of that society.

MAJOR GLENN E. EDGERTON, who has been serving as the chief engineer of the Federal Power Commission, has been relieved of those duties and has gone to the United States Military Academy, West Point, to take charge of the department of civil and military engineering.

Obituary

Edward B. Craft

Edward B. Craft, executive vice-president of the Bell Telephone Laboratories, died August 20 at his home in Hackensack, N. J., after an illness of several months. He was 47 years of age. For many years Mr. Craft had been a prominent figure among America's electrical engineers and a leader in the development of the telephone and telegraph systems of the United States. It was approximately 30 years ago that he entered the employ of the Western Electric Company in Chicago, where he worked out the first of his many inventions in the field of telephony. In 1907 he removed to New York as development engineer of the company and by 1918 he had become assistant chief engineer and was responsible for all the development work in the engineering department of the Western Electric Company, which then operated what is now known as the Bell Telephone Laboratories. Mr. Craft was among the first to advocate the dial telephone system and to its development he contributed specific inventions. Since 1922 he had had charge of all the research and development activities of the Western Electric Company in the capacity of chief engineer. Mr. Craft was a fellow of the American Institute of Electrical Engineers and of the Institute of Radio Engineers, vice-chairman of the division of engineering and industrial research of the National Research Council, chairman of the board of the Engineering Societies Library and a member of other scientific societies.

Emile Berliner

Emile Berliner, known especially for his contributions to telephony and to the science of sound reproduction, died in Washington, D. C., August 3. A native of Germany, Mr. Berliner removed to America at an early age and while engaged in commercial work of some sort he took up the study of the electric transmission of speech. In 1877 he invented the loose contact telephone transmitter or microphone, which made possible the practical application of Bell's invention. After patenting other valuable inventions in telephony, in 1887 he invented the gramophone, the first talking machine which utilized a groove of even depth and varying direction, and in which the record groove not only vibrates but also propels the stylus across the record. This invention, known in America as the Victor talking machine, won prompt recognition in this country and abroad and resulted in Mr. Berliner's being awarded the John Scott medal and the Elliot Cresson gold medal by the Franklin Institute. To Mr. Berliner is accredited the invention and perfecting of the present method of duplicating disk records. Later he extended his inventive efforts to the field of aviation, to which he has made important contributions. In addition to his activity in the field of invention Mr. Berliner has become well known for educational campaigns against dangers of raw milk and other dairy products and as the author of pamphlets dealing with the prevention of sickness.

James T. Hutchings

James T. Hutchings, vice-president of the United Gas Improvement Company in charge of engineering development, died suddenly August 17 at Ocean City, N. J. Heart disease was the cause. Mr. Hutchings had returned on August 13 from a two months' trip abroad and apparently was in his usual health. He had been in his office in the U.G.I. Building, Philadelphia, until late Friday afternoon, when he left for the seashore to spend the week-end with his family.

Mr. Hutchings entered the employ of the U.G.I. Company in 1920 as assistant general manager. In August, 1921, he became general manager and two years later was elected vice-president in charge of operations. In February, 1927, he became vice-president in charge of engineering development. His first position following graduation from Massachusetts Agricultural College was with the Thomson-Houston Electric Company, Amherst, in which he remained about four months. In that same year, 1889, he removed to Philadelphia to become foreman of wiring with the Germantown Electric Company, and later became superintendent of the West End Electric Company, in which position he remained until that company and numerous other small companies in the city were consolidated into the Philadelphia Electric Company. From 1897 to 1904 he was employed by the latter company as assistant electrical engineer. Then followed sixteen years with the Rochester Gas & Electric Corporation, during which he held the positions of superintendent of the electric department, assistant manager, general manager and president. He capably filled the last position for two years, until 1920, when he entered U.G.I. employ.

During the World War Mr. Hutchings was chairman of the manufacturers' committee of the Rochester district, in charge of production, and despite the exigencies of that and his regular work he was also power expert for the Ordnance Department in charge of munitions production. He was a member of the American Institute of Electrical Engineers, American Gas Association, Engineers' Clubs of Philadelphia and New York and of other technical associations.

Karl Auer

Karl Auer, Ritter von Welsbach, the inventor of the incandescent gas light, electric metal thread lamp and other important technical inventions, died on August 4 at Schloss, Welsbach, Carinthia, at the age of 70. He was president of the Auergesellschaft, which has large chemical works at Treibach, and a member of the Academies of Science of Vienna, Berlin and Stockholm. He was the son of Aloys Auer, Ritter von Welsbach, for many years head of the state printing works in Vienna, and himself known as an inventor of many devices in printing and paper making. Karl studied in Heidelberg under Bunsen and his researches in the chemistry of rare minerals produced several results of scientific and technical importance. His invention of the incandescent mantle was made in 1885, and five years later the company, the Auergesellschaft, which has now 4,000 employees, was formed to manufacture the Welsbach patents. The invention by Karl von Welsbach of the osmium filament lamp followed in 1897, and six years later he invented the ferrocerium compound used in pocket lighters. Many scientific bodies in his own country and abroad conferred honors upon him, and he himself endowed a number of social and scientific institutions.

Luther B. McMillan

Luther B. McMillan, for thirteen years general consulting engineer of the Johns-Manville Corporation, died August 10. A native of Bem, Mo., Mr. McMillan received his technical education at the Texas Agricultural and Mechanical College and the University of Wisconsin and after spending two years as instructor on the staff at Madison he became general consulting engineer for Johns-Manville. Mr. McMillan was a member of the American Society of Mechanical Engineers, American Society of Heating and Ventilating Engineers and the American Society of Refrigerating Engineers. Always a very active member of the A.I.E.E., he served on many important committees and was a member of the council at the time of his death. His research work on heat insulation was notable and in the course of his career he contributed numerous articles on this subject to the technical press. His services for the Johns-Manville Corporation constituted a record of marked achievement in the insulation field. Always searching for improved methods, he had to his credit the development of many important insulating materials and improvements in their manufacture and application.

Financial and Statistical News

WALL STREET attributes much of the current market buying, with consequent price advances, to accumulation on the part of expanding and newly formed investment trusts. If one is justified in assuming that the investment trust movement in this country is in its infancy—it has been predicted they may yet be as abundant as savings banks—the ratio between market price and earnings may be much more seriously distorted than at present.

——UTILITY COMMON STOCKS HAVE AN AVERAGE YIELD today of little over 2 per cent. Some of them have no yield. The investing public seems to have reached the point of utterly disregarding yield in common stocks. That is a matter for consideration in buying preferred stocks and bonds only, apparently.

——THIS WEEK'S TRADING, WHILE IRREGULAR, left many new high levels. Recovery from the discount rate scare is complete. The incident is forgotten as being merely one of the occasional corrective movements which we may expect from time to time.

——MARKET LEADERS such as American & Foreign Power, American Water Works, Electric Bond & Share and Standard Gas & Electric have been exceedingly active this week. The newly formed holding companies find it hard to break into new ground.

——FURTHER CAPITAL ADJUSTMENTS in the direction of consolidation are rumored.

Insull Utility Investments, Inc., Increases Stock

At a special meeting the stockholders of Insull Utility Investments, Inc., approved an increase in the authorized preferred stock from 250,000 to 500,000 shares. Public offering was then made of 450,000 of these shares at $100 per share. Each certificate of preferred stock will carry a non-detachable stock purchase warrant, entitling the holder to receive a number of shares of the company's common stock equal to four-fifths of the number of preferred shares turned in and transferred to the company by the holder. Proceeds from the sale of the stock will be used to discharge indebtedness incurred and toward acquiring securities of public utility companies.

Nation's Light and Power Revenue Increases 76.6 per Cent

The total revenue of commercial and municipal electric light and power plants in the United States increased 76.6 per cent from 1922 to $1,802,655,493 in 1927, according to a statement just issued by the Census of Electrical Industries. During the same five-year period the value of plant and equipment increased by 108.2 per cent to $9,297,388,356. The ratio, therefore, between revenue and value of plant and equipment has decreased materially during the period. During the same period the expenses of commercial enterprises increased 66.4 per cent, showing that, in relation to the increase in revenue, expenditures were fairly well held in check.

During the same five-year period the output of electrical energy increased by 92.6 per cent to a total of 96,828,633,719 kw.-hr. This is the total both generated and purchased by commercial and municipal plants. A more complete analysis of the report will be found in next week's issue.

Engineers Public Service to Sell Stock to Employees

C. W. Kellogg, president of Engineers Public Service Company, has announced a plan for the sale of Engineers common stock to employees of the company and of the operating utility companies which it controls. This will enable the 10,000 employees of this organization to purchase stock on time payments at $50 per share. The maximum subscription allowed is one share of stock for each $300 of annual salary and monthly payments will be $3 per share. It is expected that approximately 30,000 shares will be subscribed for under this plan.

In his letter to the employees Mr. Kellogg said: "In working out this plan the Engineers company has been actuated by the desire to make partners, on a basis advantageous to them, of the thousands of loyal men and women who are devoting their lives to the service of the public in the localities where Engineers is interested. It is in furtherance of this desire that the stock is being made available to you at a price well below its market value. I believe the plan offers you an opportunity to make your work both more interesting and more profitable. On the other hand, you should feel under no obligation to purchase stock; neither your present standing nor your future prospects with your company will be affected in the slightest degree by your decision to purchase or not to purchase."

Southern California Edison Issues New Securities

Refunding mortgage gold bonds of the Southern California Edison Company were issued during the past week to the amount of $15,000,000, the price being 98 and interest, yielding 5.14 per cent. Proceeds will be used partially for refunding purposes and to reimburse the treasury for capital expenditures.

Central & South West Utilities Offers Rights

Directors of the Central & South West Utilities Company have voted to offer to holders of common stock rights to buy one new common share at $100 for each ten shares held on September 3. On the basis of 527,500 shares outstanding the proceeds of the financing will be $5,275,000. A special meeting of stockholders has been called at Wilmington, Del., for September 16 to vote on a split-up of the common shares on a five-for-one basis. Rights to subscribe to the common stock will expire October 15 and it is planned to split the stock on that date, which will make the outstanding common stock 2,901,250 shares. The directors propose to pay dividends on the increased capitalization in the form of common stock dividends to common-stock holders at the annual rate of 4 per cent. Dividends on the present no-par common stock are at the annual rate of $3 a share. This company is controlled by the Middle West Utilities Company.

Oklahoma Utility Reports Increased Sales to Oil Fields

Strenuous efforts on the part of the commercial department of the Oklahoma Gas & Electric Company to demonstrate the superiority of electric power for oil field operation have resulted in phenomenal increases in power sales to oil fields in the nine-year period 1920-1928, inclusive. According to J. F. Owens, vice-president and general manager, these sales totaled 131,765,260 kw.-hr. for the first five months of 1929. With this figure as a basis it is esti-

mated that sales for the full year will amount to approximately 314,000,000 kw.-hr., which would compare with 264,021,114 kw.-hr. in 1928, an increase of almost 19 per cent. The following table shows the increase in power sales to oil fields since 1920:

	Kw.-Hr.
1920	829,088
1921	1,502,565
1922	2,689,457
1923	6,134,607
1924	9,423,290
1925	14,646,562
1926	32,124,995
1927	158,559,952
1928	264,021,114

Hampshire Electric Elects Officers and Directors

George W. Lawrence, Greenfield, Mass., president of the Western Massachusetts Companies, was elected president of the recently acquired Hampshire Electric Company. Mr. Lawrence becomes also chairman of the new board of directors elected by this company, as follows: George W. Lawrence, Greenfield; W. Rodman Peabody, Boston, Mass.; Lorenzo J. Scott, Springfield; Ralph Mellor, Becket, formerly president of the Hampshire company; William A. Whittlesey, Pittsfield; Fred C. Abercrombie and Robert W. Mitchell. Mr. Mellor and Mr. Mitchell are the remaining members of the old board. It is said 81.5 per cent of the Hampshire stock has been exchanged for Western Massachusetts and all the remaining stock is being turned in on the basis of one share of Western Massachusetts for each 1½ shares of Hampshire Electric.

INTERCONTINENTS POWER COMPANY DECLARES AN INITIAL DIVIDEND.—The Intercontinents Power Company declared an initial quarterly dividend of 50 cents a share on the class A common stock, payable September 1 to stock of record August 1.

RECENT LISTINGS.—New York Stock Exchange has authorized the listing of 74,250 additional shares of common stock (no par value) of the North American Company on official notice of issuance in exchange for additional shares of common stock of Western Power Corporation and Washington Railway & Electric Company, making a total of 5,481,841 shares applied for to date. The exchange has also authorized the listing of not to exceed 142,055 additional shares common stock (no par value) of the Standard Gas & Electric Company upon official notice of issuance and payment in full, making the total amount applied for not to exceed 1,979,435 shares of common stock.

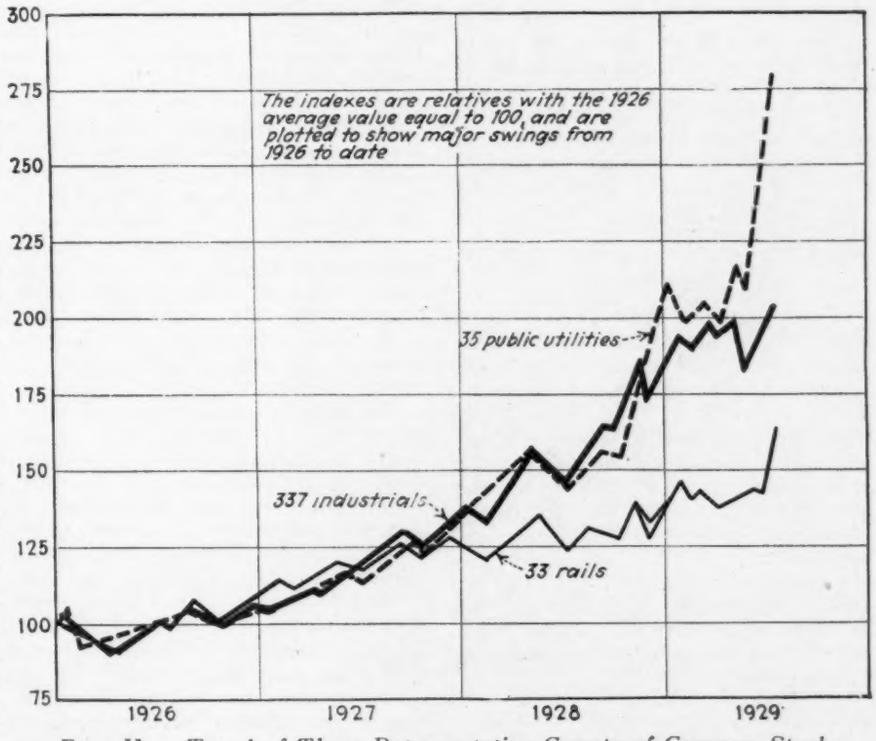
CENTRAL PUBLIC SERVICE CORPORATION OFFERS RIGHTS.—Directors of the Central Public Service Corporation have voted an offering of rights to class A and common-stock holders to subscribe to additional class A stock at $40 a share on the basis of one share of new stock for every four shares held on August 26. In view of the fact that there are at present outstanding some 74,795 shares of common and 313,962 shares of the class A stock, the new offering would increase the company's capitalization by 97,190 shares of class A and add $3,887,570 to the company's capital funds. Rights will expire September 15.

An Unmistakable Utility Market During Past Two Years

THAT the utility stocks have been favored by the public, the pools and the institutional buyers during the past two years is illustrated by the attached chart compiled by Standard Statistics, Inc., illustrating the trends of three separate groups of stocks. While following approximately the same trend during 1926 and 1927 and experiencing approximately the same market reverses, the public utility stocks and the industrials took the lead during 1928 and the rail market was left behind. Late in 1928 the public utilities took the lead from the industrials and at the end of June, 1929, their average was far above that of either of the other groups.

Reasons for the sharp advance in public utility stocks, as illustrated by the rise from 135 at the beginning of 1928 to over 275 at the middle of 1929 for the average of 35 representative utilities, are various. Probably one of the most important factors was the entrance into the field during the past two years of a large number of investment trusts whose portfolio was designed particularly to hold public utility securities along with the steady buying of utility stocks by the regular investment trusts and other investing institutions.

Other factors in the situation, of course, were the large number of mergers and consolidations during the past two years providing for, if not enormously decreased overhead costs, at least some substantial reduction in expenditures and a psychological motive for buying. This is entirely apart from the steady 8 or 10 per cent yearly growth in earnings which the power and light industry has enjoyed for a period of years, and which it will enjoy, according to present indications, for some time to come.



Four-Year Trend of Three Representative Groups of Common Stocks

CENTRAL STATES ELECTRIC DECLARES COMMON DIVIDEND.—The Central States Electric Corporation declared initial quarterly dividends of 10 cents in cash and 2½ per cent in common stock on new common, recently split three-for-one, both payable October 1 to stock of record September 5, placing stock on 40 cents cash and 10 per cent stock annual basis, as compared with $1 cash and 10 per cent stock paid annually on the old stock. The company also declared regular quarterly dividends of $1.75 on 7 per cent preferred, $1.50 on 6 per cent preferred, ⅜ of a common share, or $1.50 in cash, on series of

1928 convertible preferred and ¾ of a common share, or $1.50 in cash, on series of 1929 convertible preferred, all payable October 1 to stock of record September 5.

Seaboard Utilities Shares Makes Good Showing

The Seaboard Utilities Shares Corporation, an investment trust of the discretionary management type, whose capital stock is being distributed in the Middle West by R. E. Wilsey & Company and a group of Chicago investment houses, reports earned surplus, including realized profits only and dividends received from owned securities, amounting to $163,250 as of August 9, an increase of $40,274 over the surplus reported July 26. This does not include unrealized profits on the stocks owned, many of which were acquired some months ago, which are carried in the balance sheet at cost. The portfolio is made up of the stocks of 75 prominent holding and operating companies in the electric light, power and gas field, all in the territory east of the Mississippi River. For the same period the corporation reports an increase in securities owned (at cost) amounting to more than 100 per cent and an increase in cash in banks amounting to over 41 per cent.

More than 80 per cent of the authorized issue of 1,000,000 shares, not including 500,000 reserved for options, has been sold, it is reported, and steps are being taken to list the stock on the Chicago and other stock exchanges. An initial quarterly cash dividend of 12½ cents a share was paid July 1, 1929. The stock is being offered at $12 a share.

ELECTRICITY IN AUTOMOTIVE INDUSTRY.—In the manufacture of transportation equipment (automobiles, airplanes, locomotives, ships, etc.), the U. S. Census of Manufactures for 1927 showed a total of 2,003,853 horsepower installed as prime movers. Of this amount, 1,446,450 (or more than two-thirds) was in electric motors operating on purchased power, and approximately 475,000 was devoted to the generation of electricity by the factories themselves. About 96 per cent of all machines were electrically driven, with only 82,000 horsepower remaining as direct drive.

ELECTRICITY IN MACHINERY MANUFACTURING INDUSTRY.—Of the 3,027,926 horsepower installed as prime movers in the machinery manufacturing industry in 1927, 2,200,807, or nearly three-quarters, was in electric motors operating on power purchased from the lines of public utility enterprises, while approximately 700,000 more was devoted to driving electric generators in the establishments themselves, which, in turn, furnished current for the motors of the various individual machines. Approximately 96 per cent of all machines in this industry were electrically driven and only 127,000 horsepower remained as direct drive through belts and shafting.

MINNESOTA UTILITY INCREASES CAPITAL.—Minnesota Northern Power Company has filed a certificate at Dover, Del., increasing its authorized preferred stock (par $100) from $5,000,000 to $10,000,000 and its authorized common stock (no par value) from 60,000 shares to 800,000 shares.

ASSOCIATED GAS OFFERS STOCK TO WORKERS.—The Associated Gas & Electric System is offering its employees, of all companies controlled or affiliated with it, the right to acquire class A stock of the Associated Gas & Electric Company. Seventeen thousand employees are eligible to subscribe under this offer, which is essentially similar to that made two years ago. The plan is under the supervision of an administration committee, which purchases stock for the account of the subscribing employees from time to time and holds it until payments have been completed.

GENERAL GAS & ELECTRIC STOCKHOLDERS APPROVE CAPITAL INCREASE.—Holders of common stock class B of the General Gas & Electric Corporation at a special meeting held August 9 voted to increase the total number of shares of stock by 400,000 shares of no-par value cumulative preferred stock, the proceeds from which will be used for general corporate purposes.

Investment Trusts Help Boost Utility Quotations

INVESTMENT concerns which bought utility common stocks and held them within the past two or three years have little to regret. If their portfolio does not show a handsome appreciation there is something wrong with the investment committees concerned. Central States Electric Corporation is a good example of what can and has been done. This is one of the largest companies in the United States interested primarily in investments in public utilities. Starting with about $10,000,000 in assets, the corporation has steadily grown until on July 5 it had investments with a market value based upon closing quotations of that date of over $245,000,000. The corporation holds, in addition, other assets of substantial value, including warrants to buy large amounts of common stock of certain companies at prices below the present market.

The corporation's largest single investment is in common stock of the North American Company, of which it owns over 800,000 shares, or more than 15 per cent of the total outstanding. It also owns substantial investments in the common stocks of such companies as Consolidated Gas Company of New York, Consolidated Gas, Electric Light & Power Company of Baltimore, Detroit Edison Company, Southern California Edison Company, etc.

The company has had an impressive record, net income having increased from $519,308 in 1922 to $13,385,716 in 1929. In addition to regular cash and stock dividends, substantial extra stock dividends have been paid on the common stock, 900 per cent in February, 1926; 100 per cent in April, 1929, and 200 per cent in July, 1929. In this manner 100 shares of the common stock purchased for $1,000 in 1923 would now have become 6,000 shares worth $300,000.

One of the best-known public utility investment trusts is Electric Investors, Inc. Assets of this organization, which is Electric Bond & Share controlled, increased by 73 per cent in the past eighteen months, and this does not take into account recent market appreciation of stocks held. A surplus of about $16,000,000 had been set aside, compared with one of less than $5,000,000 eighteen months ago. The market value of the portfolio at the end of June available for common stock exceeded the book value by over $100,000,000. The popularity of this stock is reflected in its steady rise recently to over the 300 mark, against a low for the year of 77½.

Another investment organization closely associated with the Bond & Share group is American Superpower Corporation, which has minority holdings in a number of the nation's leading utility systems and operating companies. This organization showed assets at the end of February last of $245,145,939, against $71,355,177 at the end of 1927, a growth of 243 per cent in fourteen months.

Insull Utility Investments, Inc., which took a spectacular drop on the New York Curb recently, is another typical investment trust interested specifically in utilities. While a recent balance sheet of this company has not been received, assets of over $27,000,000 were shown early this year.

These are merely typical of a large number of similar institutions, including also General Gas & Electric, Seaboard Utilities Shares Corporation and others which specialize in minority holdings of public utility securities. It is obvious that these stocks are enhanced substantially by the current bull market, and they, in turn, help to create the bull market by their heavy commitments. In this way they create a situation which is cumulative in any market movement in either direction, but which is normally a stabilizing factor in the securities markets of the country.

Business News and Market Conditions

New York Electrical Show Under Professional Managers

The New York Electrical Show to be held October 7 to 12, 1929, will be sponsored by a committee jointly representing the Electrical Board of Trade of New York and the New York Electrical League, according to an announcement by Earl Whitehorne, president of both organizations. As soon as the reorganization of the two electrical associations is completed, the sponsorship will rest with the new electrical association of New York.

For the first time in the history of the show it is to be managed and staged by the International Exposition Company, which operates the Chemical Show, the Power Show, the Flower Show and others. It has been given the contract and will take entire financial responsibility, acting under the guidance of the committee.

The main floor of the show, according to the tentative plans, will be given over principally to a presentation of electricity for domestic use, together with an exhibition of industrial and commercial applications of electricity.

The exposition will be operated as a national trade show between the hours of 10 a.m. and 2 p.m., with attendance limited to members of the electrical industry. It will be open to the public from 2 p.m. to 10 p.m.

New Armored Cable Standard

A meeting on August 9 of interested manufacturers of armored cable with representatives of Underwriters' Laboratories produced a unanimous agreement relative to a new tentative standard for armored cables and cords. The provisions of this standard are to be applied to all new product submitted for labeling after October 1.

More than three years ago the industry requested Underwriters' Laboratories to undertake a research to determine the adequacy of armored cable for the service for which it is recognized by the National Electrical Code. A detailed report of the results of this research, including various recommendations, has been under consideration for some months. The recent action indorsing a new standard will make these recommendations effective.

One major improvement will be a control of the resistance of the armor to values consistent with proper fusing for the conductors involved. Thereby, overheating will be avoided unless currents not appropriate for the material are imposed upon the armor.

Change in voltage tests, in minimum requirements for weight, dimensions and convolutions are likewise recorded in the new standard, as is also a statement of the principles of fibrous inclosing coverings for the conductor assemblies. Materials labeled in good faith under existing procedures prior to October 1 should be considered standard, as should materials satisfying the new text found installed at a prior date.

Copper and Lead Demand Improves

An improved demand for copper and lead was manifest in the week ended Wednesday, lead inquiries picking up especially in the last day or two, with the improvement in the price abroad. No particular interest, however, has been exhibited in tin or silver, and zinc has been exceedingly dull, though the prices on these metals have been well maintained. The stock market has shown exceptional strength, and other signs also point to active industrial conditions in the fall and winter and an increasing consumption of metals, according to *Engineering and Mining Journal*.

Practically all sellers report more interest in copper, though the total domestic sales of approximately 14,000 tons do not indicate any particular buying wave. Even though the middle of August has passed, more than half of the sales have been for shipment this month, and practically all the rest for September delivery, indicating the continued practice of consumers to buy from hand to mouth. Brass manufacturers, as well as wire and cable concerns, report considerably improved business, but it would seem that they are not buying the copper to cover the orders they are placing on their books. The price has been uniformly 18 cents for Connecticut delivery basis and 18⅛ cents in the Middle West.

The foreign demand has been very satisfactory, especially that in England. Total sales so far in August approximate the total for the entire month of July.

NEW YORK METAL MARKET PRICES

	Aug. 14, 1929 Cents per Pound	Aug. 21, 1929 Cents per Pound
Copper, electrolytic	18	18
Lead, Am. S. & R. price	6.75	6.75
Antimony	8.625	9.87
Nickel, ingot	35	35
Zinc, spot	7.15	7.15
Tin, Straits	46.35	46.35
Aluminum, 99 per cent.	24.30	24.30

Base copper wire price Aug. 14, 1929, 18¼ cents.

Electric Industrial Trucks and Tractors

June shipments of electric industrial trucks and tractors, as reported to the Department of Commerce by the eleven leading manufacturers in the industry, were 201, as compared with 211 in May and 116 in June, 1928.

Shipments of Electric Industrial Trucks and Tractors

(In number of vehicles)

	Total	—Domestic— Tractors	All Other Types	Exports
1928				
January	112	5	98	9
February	119	15	86	18
March	129	18	95	16
April	136	9	121	6
May	114	8	93	13
June	116	6	96	14
Six months	726	61	589	76
July	107	5	87	15
August	96	5	85	6
September	118	11	102	5
October	134	5	109	20
November	132	9	117	6
December	153	10	126	17
Total (year)	1,466	106	1,215	145
1929				
January	152	4	129	19
February	134	10	121	3
March	211	14	187	10
April	194	12	169	13
May	211	28	174	9
June	201	17	168	16
Six months	1,103	85	948	70

Sharp Advance in Orders for Electrical Goods

New orders booked during the second quarter of 1929, as reported to the Department of Commerce by 81 manufacturers of electrical goods, were $340,898,469, as compared with $322,433,760 for the first quarter of 1929 and $245,520,801 for the second quarter of 1928, an increase in the latter case of 38.6 per cent. The accompanying totals of bookings for each quarter since the beginning of 1924 include motors, storage batteries, domestic appliances and industrial equipment, and are presented, not as a complete statement of the industry, but as probably sufficiently representative to indicate the trend of the distribution of electrical goods. That a steady increase has been made over a period is evident.

Orders for Electrical Goods

Quarter	1924	1925	1926	1927	1928	1929
1st	$221,687,030	$227,767,511	$255,917,883	$235,883,303	$237,508,001	*$322,433,760
2nd	216,637,855	222,056,450	240,855,953	229,353,332	245,520,801	340,898,469
3rd	181,160,835	225,184,732	233,873,171	228,610,346	264,466,257	.....
4th	225,070,111	237,225,521	251,442,991	232,877,670	282,226,449	.....
Total	$844,555,831	$912,234,214	$982,089,998	$926,724,651	$1,029,721,508	.....

*Revised.

Market Conditions

LARGE ORDERS for equipment are fewer this week, especially in the Eastern and New England districts. Business in smaller equipment is satisfactory. Industrial electrification is giving rise to substantial orders.

——MANY OF THE UTILITIES in the Middle and South West are buying in substantial volume. Cable orders are a specialty.

——MEDIUM-SIZED MOTORS AND TRANSFORMERS feature Pacific Coast business. Motor sales have fallen off in the Puget Sound area.

MIDDLE WEST

BUSINESS in the Middle West section continues on a satisfactory basis. Present conditions indicate a continuance of general prosperity, although some inactivity in certain lines is noticeable. Reports from the agricultural districts indicate favorable conditions, while the major activities of the steel, automotive and railroad industries are in excellent shape. Considerable equipment purchasing is still going on among the various railroads.

Some of the interesting orders placed this week include one for 6,000 ft. of 1,250,000-circ.mil, 12-kv. paper and lead covered cable, 100 10-kva., twenty 50-kva. and 50 75-kva., 2,080/115/230-volt pole type distribution transformers, 200,000 lb. copper busbar, switches and switch parts valued at $48,000, 20,000 lb. friction tape and several construction orders valued at $85,000. Jobbers' sales are generally satisfactory. Most appliances are moving in fair volume, with a particularly good demand noted for vacuum cleaners. Construction projects follow:

The Wisconsin Power & Light Company, Madison, Wis., plans power plant at Neshkoro, Wis., reported to cost more than $85,000. The Kohler Company, Kohler, Wis., plans addition to sanitary ware manufacturing plant to cost $1,000,000. The Economy Paper Products Company, Milwaukee, Wis., plans rebuilding of portion of wax paper manufacturing plant recently destroyed by fire with loss of $85,000. The Consolidated Paper Company, Monroe, Mich., plans addition to cost about $70,000. Lansing, Mich., will soon begin expansion and improvement program at municipal electric light and power plant to cost about $2,000,000. The Consumers Power Company, Jackson, Mich., has plans for an ice-manufacturing plant to cost $50,000. The Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich., has filed plans for an addition to cost about $85,000. The Covel Manufacturing Company, Benton Harbor, Mich., plans addition to saw filing machinery plant, reported to cost $65,000. The H. H. Cross Company, Chicago, Ill., plans oil refining plant at Muskegon, Mich., to cost $150,000. The Dallas Brass & Copper Company, Chicago, Ill., has filed plans for an addition to cost $500,000. The Commonwealth Edison Company, Chicago, Ill., plans construction of eight-story substation to cost more than $350,000. The Noblitt-Sparks Industries, Inc., Indianapolis, Ind., will build an addition to metal products plant at Greenwood, Ind., to cost $90,000. The Tokheim Oil Tank & Pump Company, Fort Wayne, Ind., plans addition to cost $100,000. The United States Corrugated Fibre Box Company, Indianapolis, Ind., will soon begin an addition, reported to cost about $75,000. The Reliance Manufacturing Company, Massillon, Ohio, plans addition to lock-nut and lock-washer plant to cost about $90,000. Hicksville, Ohio, contemplates a municipal electric light and power plant reported to cost about $40,000. The Exact Weight Scale Company, Columbus, Ohio, will build a plant to cost about $75,000. The Salt Creek Township Board of Trustees, Mount Hope, Ohio, will soon take bids for street lighting system, including underground conduits. The Standard Locomotive Equipment Company, Toledo, Ohio, plans plant to cost close to $100,000. The Hoover Company, North Canton, Ohio, plans addition to vacuum cleaner factory to cost about $100,000. The Gogan Machine & Foundry Company, Cleveland, Ohio, has filed plans for an addition to cost $75,000. The Timken Roller Bearing Company, Canton, Ohio, plans power plant at Bolivar, Ohio, reported to cost more than $75,000. The Northern States Power Company, Minneapolis, Minn., is reported planning steam-operated electric power plant at Granite Falls, Minn., capacity 20,000 kw., to cost close to $1,000,000, with transmission lines.

NEW ENGLAND

ORDERS declined in volume last week in New England. Few notable sales were recorded. Electric heating furnace deliveries for spring orders have been completed and attention is turned to new installations contemplated soon in this district, which, according to one manufacturer, are very encouraging. Sales of small melting pot furnaces have been steady; new types are being developed and are attracting interest.

One order consisting of a 1,500-kw. turbo-generator and accessories for a paper mill was reported. A few negotiations are under way for other units totaling about 16,000 kw. for Eastern projects. Small motor sales remain steady in volume, amounting to over $30,000 for this district, according to one manufacturer; general scheduled material sales fell off in volume and new construction orders were limited to supplementary lots for earlier orders.

Construction projects are as follows:

The United Illuminating Company, New Haven, Conn., has filed plans for power substation addition on Goffe Street, reported to cost about $50,000. The New Departure Manufacturing Company, Bristol, Conn., has filed plans for a power plant at ball bearing factory, reported to cost about $75,000. The Connecticut Light & Power Company, Hartford, Conn., is reported planning substation at Meriden, Conn.

EASTERN

SMALL orders are developing a volume of business in the Eastern district to more than compensate for fewer heavy commitments, and gross sales are holding well for this season of the year. Fall account looks strong, particularly in connection with railroad demand, and it is expected that record transactions will mature as a result of current electrification programs. Industrial electrification is another phase of activity which is showing upward tendencies and business pending in this line is encouraging.

Central station account, while a trifle spotty, is showing some good commitments. A power company in Michigan has closed with an Eastern manufacturer for a 4,000-kw. turbo-generator unit and is expected to duplicate the order at an early date. A central station in northern New York has placed a contract with a state maker for transformers, circuit breakers and affiliated apparatus to cost $100,000. A power utility in New Jersey has contracted with a New York company for a quantity of line equipment, including wire and cable, guy wires and other accessories, largely for replacement work, exceeding $50,000.

A feature of the week is the award of a general contract by the Philadelphia & Reading Coal & Iron Company, Philadelphia, Pa., to Stone & Webster, Inc., Boston, Mass., for the construction of two centralized electric-operated coal breakers near Locust Summit, Pa., with gross rated capacity of 25,000 tons daily, and for the complete electrification of mines tributary to the new plants, the entire program to cost about $20,000,000; purchases of equipment will be made by the contracting company. The Reading company has also given a contract to the Westinghouse Electric & Manufacturing Company for three 30,000-ton electric locomotives for coal-hauling service. Industrial business is improving in the line of motors, controls, switches and accessory apparatus. A manufacturer of air compressors in New England has placed a contract with a New York producer for motors and controls to an amount of about $30,000. A cotton oil mill in Arkansas has given an order to a Pennsylvania maker for a 660-hp. Diesel engine-electric unit. A builder of electric locomotives in New York has secured a contract from the Illinois Central Railroad Company for

five 600-hp. oil-electric units. Construction projects follow:

The Continental Can Company, New York, plans an addition to plant at Chicago, Ill., to cost about $1,000,000. The United Aircraft & Transport Corporation, New York, plans aircraft manufacturing plant at Los Angeles, Calif., to cost close to $100,000. The Associated Gas & Electric Company, New York, will carry out a 25,000-hp.. hydro-electric power project for its subsidiary, the Manila Electric Company, in the Philippine Islands, including a steel tower transmission line to operate at 110,000 volts.

The Pennsylvania Railroad Company, New York, plans a cold storage and refrigerating plant at Jersey City, N. J., to cost close to $1,000,000. The Eastern New Jersey Power Company, Asbury Park, N. J., is asking bids for an addition to power plant at Allenhurst, N. J., reported to cost more than $175,000. The Public Service Electric & Gas Company, Newark, N. J., is said to have plans under way for a power plant at Sewaren, N. J., and for plant for motorbus body manufacture on adjoining site, to cost upward of $500,000. The Individual Drinking Cup Company, Easton, Pa., plans plant addition to cost $130,000. The Lycoming Manufacturing Company, Williamsport, Pa., is having plans drawn for an addition to automobile engine plant to cost about $100,000. The Almar Stores Company, Philadelphia, Pa., will build a baking plant to cost about $300,000. The United States Engineer Office, Pittsburgh, Pa., will receive bids until September 9 for a hydro-electric plant for Deadman Island Locks, Ohio River. Quaker Field Corporation, Philadelphia, Pa., plans installation of floodlighting system and beacon lamps at proposed airport to cost in excess of $1,000,000. The Firestone Tire & Rubber Company, Akron, Ohio, plans factory branch and distributing plant at Baltimore, Md., to cost $175,000. The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until August 27 for electric cable and cord for the Philadelphia, Boston and Brooklyn navy yards (Schedule 1540). The Bureau of Yards and Docks, Navy Department, Washington, D. C., is asking bids for an ice-making and refrigerating plant for the naval ammunition depot at Hawthorne, Nev. (Specification 5907.)

SOUTHEAST

GENERAL tone of business throughout the section seems to be improved over that of a week ago, fair-sized orders being received throughout the territory. Electric ranges continue to move most satisfactorily in Georgia and Tennessee, where sales are exceeding the earlier expectations. The outlook continues good in the labor-saving appliance line for the fall season. Collections continue to show improvement, particularly in the sections of middle and south Georgia, where up to recently they have been somewhat slow.

The largest single order of the past week was for switching equipment in the Georgia territory, amounting to some $60,000, with orders for poles at $4,900, line material $10,000 and miscellaneous distribution equipment of some $12,000 additional. A single order for $30,000 for locomotive equipment to go into the Birmingham district is reported for the week just passed, while inquiries for electrical apparatus and equipment in connection with flood-control activity in Mississippi and Louisiana are being received in some volume. Construction projects follow:

The Virginia Public Service Company, Charlottesville, Va., will make enlargements in power substation at Goshen, Va., and install additional equipment. The Virginia Electric & Power Company, Richmond, Va., plans hydro-electric power plant on the Roanoke River to cost more than $1,000,000. Jackson, Tenn., has voted bonds for $750,000, for construction of municipal electric light and power, and gas plants. Laurel, Miss., plans installation of floodlighting system and beacon lamps at municipal airport to cost about $45,000. The Redland Citrus Growers' Association, Homestead, Fla., plans installation of cold storage and refrigerating plant. The Sarasota Terminal Docks, Inc., Sarasota, Fla., plans cold storage and refrigerating plant to cost about $400,000.

SOUTHWEST

INCREASED activity was shown during the past week by power companies in the purchase of equipment to take care of the additional load expected as fall business opens and the seasonal lighting peak approaches. Jobbers report August business somewhat ahead of the first three weeks in July.

Two contracts have been placed for floodlighting equipment for Light's Golden Jubilee to cost $5,000 each. One order amounting to $20,000 was placed for a power line communication system to tie in two districts of a power company in northern Arkansas, and another company bought six transformers, 833-kva., to cost $25,000. Two transformers, 5,000 kva., three phase, costing $20,000 are to be used in operating the waterworks in a Southern city. A mining company in the Southwest bought a 200-hp. synchronous motor to cost $5,000. Construction projects follow:

Savannah, Mo., contemplates municipal electric light and power plant, reported to cost $50,000. The Mon-O-Tile Concrete Products Company, Kansas City, Mo., recently organized, plans plant to cost about $70,000. Leadwood, Mo., plans ornamental lighting system. The Capper Publications, Inc., Topeka, Kan., plans printing and publishing plant addition to cost $160,000. The Oklahoma Gas & Electric Company, Oklahoma City, Okla., plans transmission line in vicinity of Cleo Springs, Okla., reported to cost $30,000. Atoka, Okla., has authorized plans for an ornamental lighting system. Muskogee, Okla., plans floodlighting system and beacon lamps at proposed municipal airport to cost $180,000. Dermott, Ark., has approved plans for ornamental lighting system. The Texas Company, Houston, Tex., plans rebuilding of portion of oil refining plant at Port Arthur, Tex., recently destroyed by fire with loss of $200,000. The Central & Southwest Utilities Company, San Antonio, Tex., plans power plant near Laredo, Tex., to cost more than $250,000. The Southwestern Public Service Company, Amarillo, Tex., plans addition to local power plant to double present capacity, reported to cost more than $250,000, and will install additional equipment at power station at Roswell, N. M. The Kansas City-Southern Railroad Company, Kansas City, Mo., plans engine house and repair shops at Dowling, Tex., in connection with terminal buildings to cost $750,000.

PACIFIC COAST

POWER apparatus manufacturers report very few large inquiries or orders, but find some compensation in continued excellent business for medium-sized motors and transformers. This demand, running about 20 per cent over last year, has broken previous records for duration and has taxed the capacity of Pacific Coast assembling plants.

Special orders include a General Electric 100-kva. motor-generator set and accessories for a steel company, a 68-kva. engine-drive outfit for a bay industrial, a $7,500 General Electric switchboard for an oil company at Martinez, Westinghouse motors and accessories for an Alaskan steamship company valued at $17,000, elevator motors and a motor-generator set for a Los Angeles steel company valued at $15,000.

Lighting installations and prospects include $25,000 worth of Westinghouse standards and tops for Los Angeles, seven airport and hangar installations for the Western Air Express, 43 duplex standards for Richmond, 136 single standards for Oakland, a $20,000 extension to a San Francisco system, fifteen standards for Pittsburg, an 80-light, $21,000 extension for Oroville and the $92,500 proposed San Pablo Avenue system for Berkeley. Power company buying has been brisk, including one carload of weatherproof wire, sizes No. 4/0 to 6; one carload of 4-in. fiber conduit, 150,000 ft. of $\frac{3}{8}$-in. single galvanized strand, eight carloads of poles for various central California destinations and special lead and paper cable inquiries aggregating $20,000. The Southern Pacific Company is in the market for 2,000 miles of No. 9 iron wire and 100,000 each of pins and glass insulators, this material being intended for various jobs that will eventually provide the entire system with semaphore and signal systems.

Motor sales in the Puget Sound area are reported the lightest since first of the year. Central-station buying is practically at a standstill. The city of Seattle is taking bids for six truck type oil circuit breakers, 2,000 kw., costing about $18,000, also for 25,000 ft. of 600-volt R.C. copper wire. The board of contracts and awards, Tacoma, is taking bids for one 6,000-kva., three-phase, 60-cycle, self-cooled transformer for general power service. The British Columbia Electric Railway plans immediate extension of power lines to serve Shawnigan Lake and Cobble Hill districts.

The town of Stevenson, Wash., plans a $70,000 hydro-electric plant and water system. Street-lighting systems are projected in Chehalis and Shelton, Wash. Contracts for the construction of an initial $3,500,000 unit of a proposed $10,000,000 pulp plant in Everett for the Puget Sound Pulp & Timber Company have been let. Construction projects follow:

San Mateo, Calif., will receive bids until September 3 for an ornamental lighting system, including underground conduits. Richmond, San Francisco, Berkeley, Los Angeles, Long Beach and San Diego, Calif., plan ornamental lighting systems. The San Francisco General Depot, Presidio, San Francisco, Calif., will receive bids until September 3 for a quantity of switchboard supplies (Circular 17). The Southern California Edison Company, Los Angeles, Calif., has approved construction of a power substation at Moneta, estimated to cost $50,000. The Neilson Steel Aircraft Company, Berkeley, Calif., plans addition to cost about $75,000. The Inland Light & Power Company, Portland, Ore., has secured authority for a hydro-electric power plant on the Lewis River, near Woodland, Wash., to cost about $20,000,000, with transmission lines. The Jantzen Knitting Mills, Inc., Portland, Ore., plans addition to cost $130,000. Boeing Airplane Company, Seattle, Wash., plans additions to cost more than $200,000.

Activities of the Trade

General Electric to Consolidate Its Distributing Units

It is reported that the General Electric Company will consolidate its fourteen wholesale distributing corporations into the General Electric Supply Corporation (of Dela.) effective October 1. These companies have for many years distributed General Electric products and the plan involves no change of ownership.

The consolidated corporation will be in a better position to offer nation-wide service through its ability to give service from any one of 76 houses, through interchangeability of stocks, and speedier and more economical operation.

C. E. Patterson will be president and a director of the new company, according to tentative organization plans, with Gerard Swope chairman.

THE OHIO BRASS COMPANY, Mansfield, Ohio, announces the opening of a new office at 505 Insurance Building, Dallas, Tex. This office will be the headquarters of T. B. Jones, district sales manager for the company in the Dallas territory.

THE DAY-FAN ELECTRIC COMPANY, Dayton, Ohio, manufacturer of radio sets, fans and motors, has been merged with the General Motors Corporation, it is announced by Lee Warren James, president of the Dayton company. The policy and personnel of the Dayton company will remain unchanged, according to C. E. Wilson, vice-president of General Motors. The deal, it is estimated, represents about $1,400,000 and was consummated with an exchange of stock.

THE ELECTRIC AUTO-LITE COMPANY of Toledo, Ohio, reports $10,200,763 earnings for the first six months of 1929. The amount is after all charges including depreciation and preferred dividends but before provisions for federal income tax. This is equal to $11.42 a share on each of the 85,855 shares of no-par value common stock outstanding. In the earnings is included $4,000,000 received by the company in connection with the sale on April 12 of a block of Dendix stock.

Soviet Places Orders for Electrical Equipment

Announcement has been made that the Soviet Government has allotted $21,000,000 for the year beginning on October 1, 1929, as part of the construction cost of the $100,000,000 Dnieper River hydro-electric project. Work began in 1927 and will be completed in 1932. When completed the plant will have ten turbo-generators of 80,000 hp. each.

Much of the equipment for the power plant and construction work has been purchased in America. An order has been placed recently with the Newport News Shipbuilding & Dry Dock Company and the International General Electric Company for four turbines of 80,000 hp. capacity directly connected to four vertical electric generators, to be the largest hydraulic turbines and generators ever built. Units of 70,000 hp. at Niagara Falls, of 54,000 hp. at Conowingo and 35,000 hp. at Muscle Shoals are the largest units in this country.

The plant will be the center of a great industrial development, which will include factories to produce fertilizers, aluminum, ferro-manganese, carbide and other products, a large steel mill and a copper smelter.

The construction of locks and the raising of the water level of the Dnieper River will make it navigable for 1,500 miles.

THE APEX ELECTRICAL COMPANY of Cleveland has acquired the Johnson Washer Company of Oakland, Calif., bringing the number of manufacturing units operated by Apex to six. The Apex company has just entered into contract with Montgomery Ward for exclusive manufacture of its Wardway model washers.

Commercial Investment Trust Has Record Year

The most prosperous six months in the history of the Commercial Investment Trust Corporation is reported for the first half of 1929, when consolidated net profits available for dividends reached a new high record of $4,042,116, compared with $2,246,590 for the corresponding period last year. After payment of preferred dividends, the earnings available for common dividends amounted to $3,650,891, equivalent to $5.59 per share on 653,509 shares, which was the average outstanding during the period. This compares with $4.14 for the same period last year.

The net volume of bills and accounts purchased in the first half of the year showed an increase of more than 100 per cent over the first half of 1928, mounting from $129,865,493 to $265,106,369. The corporation and its subsidiaries now have 134 offices in the United States and Canada, which is almost double the number in operation a year ago. Fourteen offices are operated in foreign countries.

STEEL & TUBES, INC., Cleveland, manufacturer of steel tubing, etc., has opened a new welded steel tubing plant at Ferndale (Detroit), Mich. This new unit will take the place of a former plant at Toledo, Ohio, but will be much larger, containing 113,000 sq.ft. of floor space.

THE ALLEN-BRADLEY COMPANY, 286 Greenfield Avenue, Milwaukee, manufacturer of alternating-current and direct-current automatic starters and radio resistors, has appointed the Ward Engineering Company, Inc., Barnett National Bank Building, Jacksonville, Fla., as its representative for the Jacksonville territory. R. E. Ward previously represented the Allen-Bradley Company in Cincinnati before moving to Florida. A complete stock will be carried to give prompt deliveries to manufacturers.

FAIRBANKS, MORSE & COMPANY reports for six months ended June 30, 1929, a net profit of $1,121,826 after depreciation, interest and federal taxes, equivalent, after 7 per cent preferred dividend requirements, to $2.38 a share earned on 368,977 no-par shares of common stock. This compares with $1,004,408, or $2.04 a share, in the first half of 1928. Net profit for the quarter ended June 30 amounted to $715,066 after above charges, equal to $1.61 a share on common, comparing with $406,760, or 77 cents a share, in the preceding quarter and $594,960, or $1.27 a share, in the June quarter of the previous year. Orders received during the first six months of this year totaled $18,004,026, comparing with $16,979,597 for the first half of the previous year. Unfilled orders on the books at the end of June were nearly double the amount at the beginning of the year.

New Equipment Available

Ross Safety Control

A new safety control, consisting of two electrical magnets with one closing coil and one opening coil energized momentarily during the period of operation, is announced by the Ross Safety Switch Corporation, New York.

It is claimed that the Ross safety control does not chatter through vibration or drop in voltage. It is also claimed that the coils cannot overheat or burn out through overloading or varying

voltages because the coils are never in circuit except at the moment of performing their function. No transformer is required in connection with the load or control contacts. The Ross safety control is universal and may be used on either direct or alternating current without the use of auxiliary transforming apparatus.

The Ross safety control is applicable to any electric-consuming device at any voltage and amperage, insuring maximum safety in homes and public buildings, steamships, railroad stations, etc.

"Flex-a-power" for Use in Industrial Plants

A new assembly for industrial power distribution under the trade name "Flex-a-power" is announced by the Trumbull Electric Manufacturing Company of Plainville,, Conn. "Flex-a-power" has been designed and produced to provide extreme flexibility in the use of power in industrial plants.

The new product has been termed the "convenience outlet for power in industry" by its manufacturer, who claims that it provides the only flexible system of convenient power outlets which answers all the demands of plants where production requirements necessitate the frequent shifting or replacement of machinery. Standard lengths are joined to form any desirable plan for power distribution regardless of peculiarities of existing conditions, since it provides complete distribution of power from the secondary power source to the last motor in the plant. It is equally applicable to storage battery truck charging, electric welding distribution, vertical and horizontal methods of construction and various other uses. According to the manufacturer on one particular recent installation "Flex-a-power" reduced the expense of machine moves about 95 per cent and the loss of electrical material was less than 2 per cent of what it would have been had conduit, wire and panels been used.

Switch and Receptacle Combination

A new product of the Bryant Electric Company is its No. 2989 switch and receptacle combination. This consists of a "Spartan" T-slot flush receptacle with the Bryant finding rib in a single gang unit with a double-pole tumbler switch, vertically operated. The device has a Bakelite cup, the plate is made of Templus and the boss is integral with the plate. The receptacle has the standard rating of 15 amp., 125 volts; 10 amp., 250 volts, while the switch has the full 10-amp., 250-volt rating of a double-pole tumbler switch.

The manufacturer calls attention to the practical, sturdy switch mechanism and the strong steel commutator carrier. Samples of this device have tested on endurance 107,800 cycles average before failure.

Multifinger Device

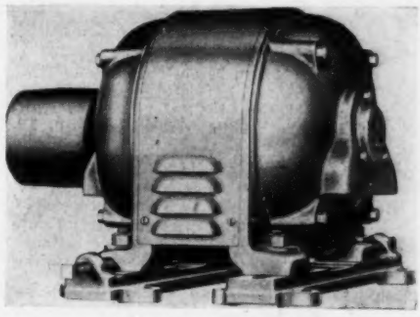
A new relay designated DR-2820-1080, a multifinger alternating-current device for general purpose use, is announced by the General Electric Company.

The relay consists of a series of double-break silver-faced fingers, operating horizontally and controlled by a small solenoid. The power consumption of the solenoid coil is 8 watts. The complete assembly is on a molded base, over which fits a drawn-shell cover. The base is provided with holes through which leads may be run when the relay is mounted as a panel device. Creepage and clearance for 550 volts have been provided. The contacts will carry 15 amp. continuously.

By varying the arrangement of the contact fingers, the relay may be arranged for a number of different types of application. The relay may be used also when a number of independent circuits are to be controlled remotely and will be useful on signal and indicating circuits, emergency throw-over controls and similar applications, it is claimed by the manufacturer.

"Uniclosed" Motor

Certain radical changes in design are claimed for a new "uniclosed" motor, just announced by the United States Electrical Manufacturing Company of Los Angeles, Calif. While not totally inclosed the new motor offers the desired inclosing features, having a pressed steel housing. It embodies a dual fan blast, auto-start principle, asbestos protection, solid die-cast aluminum rotor and ball bearing application. The active unit is shielded. The cover can be removed quickly by loosening



four screws. This exposes the air passages for inspection and cleaning. There is no direct exposure of the windings. The internal parts are shielded from water and against abrasive substances.

Small Parts Heat-Treating Furnace

A new electric furnace for heat treating small parts is announced by the General Electric Company, the use of which is claimed to result in material saving in labor involved in this process. It is of the mesh-belt conveyor type and the automatic feed and discharge effects the labor saving. The furnace is rectangular, about 8 ft. long, 4 ft. wide and 4½ ft. high over all.

The principal feature of the furnace is the mesh-belt conveyor made of heat-resisting alloy. The driving mechanism is so designed that slack is automatically taken up when the belt is hot. The mesh-belt is carried over two drums of the heat-resisting alloy, one of which is driven by a motor through a suitable gear reduction and speed transmission.

The furnace can be adjusted for various speeds and temperatures and an adjustable opening at the feed end accommodates work of different dimensions. After heat treating, the work is discharged into a chute which may carry it to a box, quenching bath or some other subsequent process. By a suitable distribution of the heating units, uniform heating is maintained throughout the entire cycle, and the automatic control will maintain a constant temperature within 5 to 10 deg. F. The furnace will handle up to 300 lb. per hour, in shapes up to 16 in. by 2½ in. over all.

Electrical Patents

Announced by U. S. Patent Office

(Issued August 6, 1929)

1,723,626. CARBON SAVER; Morris Kravitz and Harry W. Kiks, Brooklyn, N. Y. App. filed Feb. 5, 1927.

1,723,627. REGULATING DEVICE FOR ARC LAMPS; Franz Meyer, of Jena, Germany. App. filed Jan. 28, 1928.

1,723,635. AUTOMATIC PRESSURE CONTROL SWITCH; Vernon L. Tannehill, Fort Wayne, Ind. App. filed May 16, 1927.

1,723,645. ATTACHMENT FOR CIGAR LIGHTERS, TROUBLE LAMPS, ETC.; Charles H. Cuno, Meriden, Conn. App. filed May 19, 1924.

1,723,659. METHOD OF FORMING HOLLOW ARTICLES; Gunnar Rosenquist, Pittsurgh, Pa. App. filed Nov. 16, 1926.

b1,723,670. GAS TUBE MOUNTING; Charles J. Wamser, Milwaukee, Wis. App. filed Aug. 3, 1928.

1,723,683. ELECTRIC SWITCH; Harry A. Douglas, Bronson, Mich. App. filed Nov. 17, 1927.

1,723,708. ELECTRIC SIGNAL; Carl A. Ranning, Seattle, Wash. App. filed Jan. 10, 1927.

1,723,727. ELECTRIC BATTERY AND METHOD FOR MAKING SAME; Reuben Eckstein, New York, N. Y. App. filed March 17, 1927.

1,723,733. ELECTRIC WATER HEATER; Louis B. Hyde and Michel S. Gazelle, Detroit, Mich. App. filed Mar. 28, 1928.

1,723,732. APPARATUS FOR THE COMPENSATION OF ASYNCHRONOUS MACHINES BY SHUNT COMMUTATOR MOTORS CONNECTED IN CASCADE; Ludwig Hartwagner, Dresden, Germany. App. filed July 21, 1925.

1,723,738. ELECTRIC STEAM GENERATOR; James S. Lang, Boston, Mass. App. filed June 17, 1927.

1,723,743. HEATER; Richard C. Mason, Tulsa, Okla. App. filed July 2, 1927.

1,723,745. DIMMING APPARATUS; William E. McLaughlin, Middletown, Ohio. App. filed Nov. 25, 1925.

1,723,750. FUSE TESTING DEVICE; William J. Shore, New York, N. Y. App. filed Oct. 27, 1927.

1,723,755. POLYPHASE MOTOR CONTROL SYSTEM; William R. Yorkey, East Orange, N. J. App. filed Sept. 16, 1925.

1,723,758. ELECTRIC SWITCH; Raymond W. Armstrong and Ira E. McCabe, Chicago, Ill. App. filed Sept. 20, 1926.

1,723,760. ELECTRODE HOLDER; Frederick M. Bowers, Chester, Pa. App. filed Oct. 17, 1927.

1,723,806. INCUBATOR; Ire Melancthon Petersime, Gettysburg, Ohio. App. filed Jan. 12, 1926.

1,723,812. HOLLOW ROPE CONDUCTOR FOR OVERHEAD TRANSMISSION LINES; Arthur Schalkau, Berlin-Charlottenburg, Germany. App. filed June 22, 1926.

1,723,830. METHOD OF AND MEANS FOR CONTROLLING RECIPROCATING MOTORS; Carl S. Weyandt, Pittsburgh, Pa. App. filed Feb. 15, 1924.

1,723,837. DISCONNECTING SWITCH; Arthur O. Austin, Barberton, Ohio. App. filed Aug. 11, 1924.

1,723,839. ELECTRICAL APPARATUS; Locke H. Burnham, Pittsfield, Mass. App. filed Feb. 23, 1928.

1,723,840. TRANSFORMER; Locke H. Burnham, Pittsfield, Mass. App. filed Dec. 14, 1928.

1,723,845. SWITCH FOR AUTOMOBILE SIGNALING APPARATUS; Charles J. Diehl, New York, N. Y. App. filed Dec. 13, 1927.

1,723,846. INSULATED CABLE JOINT; Eugene D. Eby, Pittsfield, Mass. App. filed March 10, 1925.

1,723,851. ELECTRIC POWER GENERATING UNIT; Harold D. Gumpper, Detroit, Mich. App. filed Oct. 22, 1928.

1,723,857. ELECTRIC POWER SYSTEM; Henry M. Hobart, Schenectady, N. Y. App. filed Dec. 21, 1921.

1,723,858. CIRCUIT BREAKER; Albert W. Hull, Schenectady, N. Y. App. filed Aug. 4, 1921.

1,723,861. INSULATOR TESTER; Teizo Isshiki, Tokyo, Japan. App. filed July 13, 1925.

1,723,862. PROCESS FOR THE MANUFACTURE OF DRAWN TUNGSTEN WIRES; Richard Jacoby, Berlin, Germany. App. filed June 16, 1921.

1,723,870. PROTECTIVE ARRANGEMENT; Sydney Maurice Lejeune and Herbert Stanley Petch, London, England. App. filed Sept. 28, 1927.

1,723,872. LIGHTNING ARRESTER; Norman A. Lougee, Schenectady, N. Y. App. filed Oct. 3, 1921.

1,723,876. ELECTRIC SWITCH INSTALLATION; Samuel W. Mauger, Schenectady, N. Y. App. filed July 23, 1924.

1,723,882. AUTOMATIC LIGHTING DEVICE FOR AUTOS; Albert Parker, Providence, R. I. App. filed Apr. 21, 1928.

1,723,884. CIRCUIT CONTROL SYSTEM; Adalbert, Pascher, Neufinkenkrug, Germany. App. filed Mar. 17, 1926.

1,723,903. BATTERY CHARGING DEVICE; Henry S. Werner, Memphis, Tenn. App. filed Mar. 25, 1925.

1,723,906. SYSTEM OF SHIP PROPULSION; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Jan. 2, 1923.

1,723,911. SYSTEM OF ELECTRICAL DISTRIBUTION; Theophilus F. Barton, Upper Montclair, N. J. App. filed Nov. 15, 1927.

1,723,912. DYNAMO ELECTRIC MACHINE; Sven R. Bergman, of Nahant, Mass. App. filed Feb. 15, 1928.

1,723,915. ELECTRIC SWITCH; Walter W. Brown, Erie, Pa. App. filed Apr. 23, 1926.

1,723,920. ELECTRIC INCANDESCENT LAMP; Paul O. Cartun, Cleveland Heights, Ohio. App. filed June 9, 1925.

1,723,929. LUMINOUS ELECTRIC DISCHARGE TUBE; Regnier Francotte, Brussels, Belgium. App. filed Oct. 2, 1926.

1,723,933. ELECTRIC SWITCH; Howard R. Harrison, Baltimore, Md. App. filed July 5, 1927.

1,723,056. LOCK MECHANISM; William H. Schuerman, Nashville, Tenn. App. filed June 3, 1927.

1,723,964. CLOCK SYNCHRONIZING MECHANISM; Russell M. Wood, Plainfield, N. J. App. filed May 29, 1925.

1,723,965. STAND AND SWITCH FOR ELECTRIC HEATING DEVICES; Grover F. Behringer, Defiance, Ohio. App. filed Dec. 21, 1925.

1,723,984. ELECTRIC WELDING MACHINE; Edmund J. von Henke, Chicago, Ill. App. filed Sept. 11, 1926.

1,723,997. DOMESTIC OIL BURNER; Lloyd I. Aldrich, Peoria, Ill. App. filed June 23, 1924.

(Issued August 13, 1929)

1,724,014. ELECTRIC CIRCUIT AND FUSE TESTER; L. H. Garaux, North Canton, O. App. filed Sept. 21, 1925.

1,724,022. ELECTRIC FUSE; J. H. Hickey, San Francisco, Cal. App. filed March 28, 1927.

1,724,024. SWITCH CONSTRUCTION; E. N. Jacobi, Milwaukee, Wis. App. filed April 13, 1927.

1,724,039. SWITCH BUTTON; T. L. Parker, Chicago, Ill. App. filed Dec. 27, 1926.

1,724,065. RECTIFIER ELECTRODE; C. W. Balke, Highland Park, Ill. App. filed Jan. 14, 1928.

1,724,112. COMMUNICATING SYSTEM FOR POWER-TRANSMISSION LINES; M. L. Sindeband, N. Y., G. N. Tidd, Elizabeth, N. J. J. W. Milnor, New York, N. Y. App. filed Jan. 28, 1920.

1,724,119. SWITCH-CONTROL GEAR; C. I. Vermilye, Flushing, N. Y. App. filed Nov. 29, 1926.

1,724,132. IGNITING APPARATUS FOR BURNERS; G. H. Hart, West Hartford, Conn. App. filed Aug. 17, 1925.

1,724,136. ENGINE-STARTING APPARATUS; C. H. Kindl, Anderson, Ind. App. filed Dec. 31, 1925.

1,724,155. ELECTRICALLY-WOUND CLOCK; R. H. Wilmeth, Springfield, Ill. App. filed Oct. 4, 1926.

1,724,164. ELECTRIC STOVE; C. C. Armstrong, Huntington, W. Va. App. filed Aug. 3, 1925.

1,724,195. SPARK-PLUG TESTER; R. E. Hantzsch, East Orange, N. J. App. filed Jan. 18, 1922.

1,724,197. VIBRATORY REGULATOR; H. L. Hartzell, Anderson, Ind. App. filed Nov. 29, 1927.

1,724,198. ELECTRIC HEATER; G. D. Hauser, Utica, N. Y. App. filed June 30, 1927.

1,724,210. SELECTIVE APPARATUS; M. H. Loughbridge, Bogota, N. J. App. filed June 16, 1921.

1,724,214. BATTERY CONNECTER; E. S. Miller, Roanoke, Va. App. filed April 28, 1928.

1,724,232. PIEZO ELECTRIC CRYSTAL; A. H. Taylor, A. Crossley, Washington, D. C. App. filed Oct. 14, 1925.

1,724,247. MULTIPLE HEAT ELECTRIC COOKER; H. A. Ziola, Toledo, O. App. filed May 20, 1926.

1,724,263. ELECTRICAL DEHYDRATOR; W. O. Eddy, Los Angeles, Cal. App. filed July 5, 1928.

New Trade Literature

NARROW-TYPE SWITCHBOARD METERS.—Bulletin No. 73 dealing with the Sangamo type HN alternating current switchboard meter has just been issued by the Sangamo Electric Company, Springfield, Ill. The bulletin describing these vertical type meters is well illustrated and contains detailed technical data as well as a schedule of prices.

DROP-FORGED PIPE FITTINGS.—The Delta Star Electric Company, Chicago, has ready for distribution bulletin No. 70 describing and listing its new drop-forged "Uniclamp" pipe fittings. This is a radically new type of fitting, comprising five parts from which innumerable combinations can be assembled in the field.

GEARED-TURBINE GENERATOR UNITS.—Leaflet L-20377 has been issued by the Westinghouse Electric & Manufacturing Company on geared-turbine generator units. The leaflet brings out several new features on the compact unit, such as requiring no bedplate because cylinder and gear housing are supported from generator frame, short over-all length of the set, rigidity obtained by means of only four bearings, and the unit requiring only piping and electrical connections before being ready for operation. The geared-turbine generator units may be obtained in either the 30 or 50 kw. units.

OIL CIRCUIT BREAKERS.—The Westinghouse Electric & Manufacturing Company is distributing circular 1852, a new four-page booklet on types F-24 and F-24-R oil circuit breakers for medium interrupting capacity usage. These breakers can be supplied in two-, three- and four-pole arrangements with current ratings of 400-, 600- and 800-amp. at operating voltages of 15,000 or less. They are for indoor use and can be manually or electrically operated. A description of the different methods of mounting of these breakers and the construction as a whole and in detail is included. Tables are provided covering the closing and tripping currents for solenoid and motor mechanism, interrupting capacities, shipping weights, mounting details, and the various accessories and attachments. Dimension drawings of the complete breaker and details are shown.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Havana, Cuba (No. 40,278), of storage batteries.

An agency is sought in Buenos Aires, Argentina (No. 40,292), for storage batteries.

An agency and purchase are sought in Bombay, India (No. 40,305), for storage batteries.

An agency and purchase are sought in Milan, Italy (No. 40,345), for battery tools.

An agency is sought in Zurich, Switzerland (No. 40,294), for electrical drills.

An agency is desired in Vancouver, B. C. (No. 40,287), for electrical glue pots.

An agency and purchase are sought in Saigon, Indo-China (No. 40,291), for household electrical equipment.

An agency is sought in Montreal, Que. (No. 40,297), for repulsion, induction and split-phase motors.

An agency is desired in Vancouver, B. C. (No. 40,287), for motors and controls.

An agency and purchase are sought in Berlin, Germany (No. 40,295), for electrical refrigerators.

An agency and purchase are sought in Saigon, Indo-China (No. 40,291), for household electrical refrigerators.

An agency is desired in Milan, Italy (No. 40,407), for television apparatus.

An agency is sought in Calais, France (No. 40,293), for ultra-violet ray outfits.

Agency and purchase are sought in Bombay, India (No. 40,401), for electrical wiring supplies.